Online ISSN: 2249-4626
Print ISSN: 0975-5896

Global Journal of Science Frontier Research: A

Physics and Space Science

Highlights

- Modified Radar Signal
- Supersymmetry Quantum Mechanics
- Vorticity Distribution Function
- Mass of Schrodinger Equations

Discovering Thoughts, Inventing Future

VOLUME 14 ISSUE 5 VERSION 1.0

© 2001-2014 by Global Journal of Science Frontier Research , USA

Global Journal of Science Frontier Research: A
Physics & Space Science

Global Journal of Science Frontier Research: A
Physics & Space Science

Volume 14 Issue 5 (Ver. 1.0)

Open Association of Research Society

© Global Journal of Science Frontier Research. 2014.

All rights reserved.

This is a special issue published in version 1.0 of "Global Journal of Science Frontier Research." By Global Journals Inc.

All articles are open access articles distributed under "Global Journal of Science Frontier Research"

Reading License, which permits restricted use. Entire contents are copyright by of "Global Journal of Science Frontier Research" unless otherwise noted on specific articles.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without written permission.

The opinions and statements made in this book are those of the authors concerned. Ultraculture has not verified and neither confirms nor denies any of the foregoing and no warranty or fitness is implied.

Engage with the contents herein at your own risk.

The use of this journal, and the terms and conditions for our providing information, is governed by our Disclaimer, Terms and Conditions and Privacy Policy given on our website http://globaljournals.us/terms-and-condition/menu-id-1463/

By referring / using / reading / any type of association / referencing this journal, this signifies and you acknowledge that you have read them and that you accept and will be bound by the terms thereof.

All information, journals, this journal, activities undertaken, materials, services and our website, terms and conditions, privacy policy, and this journal is subject to change anytime without any prior notice.

Incorporation No.: 0423089
License No.: 42125/022010/1186
Registration No.: 430374
Import-Export Code: 1109007027
Employer Identification Number (EIN):
USA Tax ID: 98-0673427

Global Journals Inc.

*(A Delaware USA Incorporation with "Good Standing"; **Reg. Number: 0423089**)*

Sponsors: Open Association of Research Society
Open Scientific Standards

Publisher's Headquarters office

Global Journals Headquarters
301st Edgewater Place Suite, 100 Edgewater Dr.-Pl,
Wakefield MASSACHUSETTS, Pin: 01880,
United States of America
USA Toll Free: +001-888-839-7392
USA Toll Free Fax: +001-888-839-7392

Offset Typesetting

Global Journals Incorporated
2nd, Lansdowne, Lansdowne Rd., Croydon-Surrey,
Pin: CR9 2ER, United Kingdom

Packaging & Continental Dispatching

Global Journals
E-3130 Sudama Nagar, Near Gopur Square,
Indore, M.P., Pin:452009, India

Find a correspondence nodal officer near you

To find nodal officer of your country, please email us at *local@globaljournals.org*

eContacts

Press Inquiries: *press@globaljournals.org*
Investor Inquiries: *investors@globaljournals.org*
Technical Support: *technology@globaljournals.org*
Media & Releases: *media@globaljournals.org*

Pricing (Including by Air Parcel Charges):

For Authors:
22 USD (B/W) & 50 USD (Color)
Yearly Subscription (Personal & Institutional):
200 USD (B/W) & 250 USD (Color)

Integrated Editorial Board
(Computer Science, Engineering, Medical, Management, Natural Science, Social Science)

John A. Hamilton,"Drew" Jr.,
Ph.D., Professor, Management
Computer Science and Software Engineering
Director, Information Assurance Laboratory
Auburn University

Dr. Henry Hexmoor
IEEE senior member since 2004
Ph.D. Computer Science, University at Buffalo
Department of Computer Science
Southern Illinois University at Carbondale

Dr. Osman Balci, Professor
Department of Computer Science
Virginia Tech, Virginia University
Ph.D.and M.S.Syracuse University, Syracuse, New York
M.S. and B.S. Bogazici University, Istanbul, Turkey

Yogita Bajpai
M.Sc. (Computer Science), FICCT
U.S.A.Email:
yogita@computerresearch.org

Dr. T. David A. Forbes
Associate Professor and Range Nutritionist
Ph.D. Edinburgh University - Animal Nutrition
M.S. Aberdeen University - Animal Nutrition
B.A. University of Dublin- Zoology

Dr. Wenying Feng
Professor, Department of Computing & Information Systems
Department of Mathematics
Trent University, Peterborough,
ON Canada K9J 7B8

Dr. Thomas Wischgoll
Computer Science and Engineering,
Wright State University, Dayton, Ohio
B.S., M.S., Ph.D.
(University of Kaiserslautern)

Dr. Abdurrahman Arslanyilmaz
Computer Science & Information Systems Department
Youngstown State University
Ph.D., Texas A&M University
University of Missouri, Columbia
Gazi University, Turkey

Dr. Xiaohong He
Professor of International Business
University of Quinnipiac
BS, Jilin Institute of Technology; MA, MS, PhD,. (University of Texas-Dallas)

Burcin Becerik-Gerber
University of Southern California
Ph.D. in Civil Engineering
DDes from Harvard University
M.S. from University of California, Berkeley & Istanbul University

Dr. Bart Lambrecht
Director of Research in Accounting and FinanceProfessor of Finance
Lancaster University Management School
BA (Antwerp); MPhil, MA, PhD (Cambridge)

Dr. Carlos García Pont
Associate Professor of Marketing
IESE Business School, University of Navarra
Doctor of Philosophy (Management), Massachusetts Institute of Technology (MIT)
Master in Business Administration, IESE, University of Navarra
Degree in Industrial Engineering, Universitat Politècnica de Catalunya

Dr. Fotini Labropulu
Mathematics - Luther College
University of ReginaPh.D., M.Sc. in Mathematics
B.A. (Honors) in Mathematics
University of Windso

Dr. Lynn Lim
Reader in Business and Marketing
Roehampton University, London
BCom, PGDip, MBA (Distinction), PhD, FHEA

Dr. Mihaly Mezei
ASSOCIATE PROFESSOR
Department of Structural and Chemical Biology, Mount Sinai School of Medical Center
Ph.D., Etvs Lornd University
Postdoctoral Training,
New York University

Dr. Söhnke M. Bartram
Department of Accounting and FinanceLancaster University Management SchoolPh.D. (WHU Koblenz)
MBA/BBA (University of Saarbrücken)

Dr. Miguel Angel Ariño
Professor of Decision Sciences
IESE Business School
Barcelona, Spain (Universidad de Navarra)
CEIBS (China Europe International Business School).
Beijing, Shanghai and Shenzhen
Ph.D. in Mathematics
University of Barcelona
BA in Mathematics (Licenciatura)
University of Barcelona

Philip G. Moscoso
Technology and Operations Management
IESE Business School, University of Navarra
Ph.D in Industrial Engineering and Management, ETH Zurich
M.Sc. in Chemical Engineering, ETH Zurich

Dr. Sanjay Dixit, M.D.
Director, EP Laboratories, Philadelphia VA Medical Center
Cardiovascular Medicine - Cardiac Arrhythmia
Univ of Penn School of Medicine

Dr. Han-Xiang Deng
MD., Ph.D
Associate Professor and Research Department Division of Neuromuscular Medicine
Davee Department of Neurology and Clinical NeuroscienceNorthwestern University Feinberg School of Medicine

Dr. Pina C. Sanelli
Associate Professor of Public Health
Weill Cornell Medical College
Associate Attending Radiologist
NewYork-Presbyterian Hospital
MRI, MRA, CT, and CTA
Neuroradiology and Diagnostic Radiology
M.D., State University of New York at Buffalo,School of Medicine and Biomedical Sciences

Dr. Roberto Sanchez
Associate Professor
Department of Structural and Chemical Biology
Mount Sinai School of Medicine
Ph.D., The Rockefeller University

Dr. Wen-Yih Sun
Professor of Earth and Atmospheric SciencesPurdue University Director National Center for Typhoon and Flooding Research, Taiwan University Chair Professor Department of Atmospheric Sciences, National Central University, Chung-Li, TaiwanUniversity Chair Professor Institute of Environmental Engineering, National Chiao Tung University, Hsin-chu, Taiwan.Ph.D., MS The University of Chicago, Geophysical Sciences
BS National Taiwan University, Atmospheric Sciences
Associate Professor of Radiology

Dr. Michael R. Rudnick
M.D., FACP
Associate Professor of Medicine
Chief, Renal Electrolyte and Hypertension Division (PMC)
Penn Medicine, University of Pennsylvania
Presbyterian Medical Center, Philadelphia
Nephrology and Internal Medicine
Certified by the American Board of Internal Medicine

Dr. Bassey Benjamin Esu
B.Sc. Marketing; MBA Marketing; Ph.D Marketing
Lecturer, Department of Marketing, University of Calabar
Tourism Consultant, Cross River State Tourism Development Department
Co-ordinator , Sustainable Tourism Initiative, Calabar, Nigeria

Dr. Aziz M. Barbar, Ph.D.
IEEE Senior Member
Chairperson, Department of Computer Science
AUST - American University of Science & Technology
Alfred Naccash Avenue – Ashrafieh

President Editor (HON.)

Dr. George Perry, (Neuroscientist)
Dean and Professor, College of Sciences
Denham Harman Research Award (American Aging Association)
ISI Highly Cited Researcher, Iberoamerican Molecular Biology Organization
AAAS Fellow, Correspondent Member of Spanish Royal Academy of Sciences
University of Texas at San Antonio
Postdoctoral Fellow (Department of Cell Biology)
Baylor College of Medicine
Houston, Texas, United States

Chief Author (HON.)

Dr. R.K. Dixit
M.Sc., Ph.D., FICCT
Chief Author, India
Email: authorind@computerresearch.org

Dean & Editor-in-Chief (HON.)

Vivek Dubey(HON.)
MS (Industrial Engineering),
MS (Mechanical Engineering)
University of Wisconsin, FICCT
Editor-in-Chief, USA
editorusa@computerresearch.org

Sangita Dixit
M.Sc., FICCT
Dean & Chancellor (Asia Pacific)
deanind@computerresearch.org

Suyash Dixit
(B.E., Computer Science Engineering), FICCTT
President, Web Administration and
Development , CEO at IOSRD
COO at GAOR & OSS

Er. Suyog Dixit
(M. Tech), BE (HONS. in CSE), FICCT
SAP Certified Consultant
CEO at IOSRD, GAOR & OSS
Technical Dean, Global Journals Inc. (US)
Website: www.suyogdixit.com
Email:suyog@suyogdixit.com

Pritesh Rajvaidya
(MS) Computer Science Department
California State University
BE (Computer Science), FICCT
Technical Dean, USA
Email: pritesh@computerresearch.org

Luis Galárraga
J!Research Project Leader
Saarbrücken, Germany

Contents of the Issue

i. Copyright Notice
ii. Editorial Board Members
iii. Chief Author and Dean
iv. Contents of the Issue
v. Research and Review Papers

1. Target Distance Direct Determination from QPSK Mapped OFDM Modified Radar Signal. *1-3*
2. Some Exact Solutions of Non-Newtonian Fluid in Porous Medium with hall Effect Having Prescribed Vorticity Distribution Function. *5-11*
3. Search for Four-Charged Lepton from Decay Doubly-Charged Higgs Pair Production at the Hadron Colliders. *13-24*
4. Supersymmetry Quantum Mechanics and Exact Solutions of the Effective Mass of Schrodinger Equations with Rosen-Morse Potential. *25-30*

vii. Auxiliary Memberships
viii. Process of Submission of Research Paper
ix. Preferred Author Guidelines
x. Index

Global Journal of Science Frontier Research: A
Physics and Space Science
Volume 14 Issue 5 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Target Distance Direct Determination from QPSK Mapped OFDM Modified Radar Signal

By A.A.Hakhoumian
Institute of Radiophysics & Electronics of NAS of Armenia, Armenia

Abstract- Time shift of the target reflected signal in radar system can be calculated directly from modified QPSK mapped OFDM signal. It makes possible to determine target distance from radar station. When time shift respecting to phase delay depends on OFDM subcarrier number, modified OFDM signal prevents that dependence and lets system to decide the phase delay directly from QPSK-OFDM signal rotation angle of constellation points. Additionally, proposed system requires low computing resources as the entire calculation process could be done during a single OFDM symbol.

Keywords: OFDM, radar, constellation, signal processing, QPSK, time shift, target distance.

GJSFR-A Classification : FOR Code: 249999p

TARGETDISTANCEDIRECTDETERMINATIONFROMQPSKMAPPEDOFDMMODIFIEDRADARSIGNAL

Strictly as per the compliance and regulations of :

© 2014. A.A.Hakhoumian. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Target Distance Direct Determination from QPSK Mapped OFDM Modified Radar Signal

A.A.Hakhoumian

Abstract- Time shift of the target reflected signal in radar system can be calculated directly from modified QPSK mapped OFDM signal. It makes possible to determine target distance from radar station. When time shift respecting to phase delay depends on OFDM subcarrier number, modified OFDM signal prevents that dependence and lets system to decide the phase delay directly from QPSK-OFDM signal rotation angle of constellation points. Additionally, proposed system requires low computing resources as the entire calculation process could be done during a single OFDM symbol.

Keywords: OFDM, radar, constellation, signal processing, QPSK, time shift, target distance.

I. Introduction

OFDM signals are in focusfor radar applications due to high time bandwidth product[1, 2]. One of the main applications occurring during utilization of OFDM signals in radar systems is the signal processing which detect target parameters - distance and velocity. One of proposed method based on solving of matrix equations or 2D Fourier transform need high computing resources [3,4].

Previously it was presented new method based on QPSK-OFDM signal constellation processing which make possible to detect Doppler shift and accordingly target velocity [5]. Unfortunately that method couldn't be done directly, without solving target distance detection. It is presented below a new method again based on constellation processing which let to calculate target distance and make previous presented method more reliable and applicable.

II. Calculation Scheme of time delay from Modified OFDM Radar Signal

Target distance estimation in radar system is calculation of time, during which transmitted signal travel to the target and back to the receiver.

$$\tau = \frac{2D}{c} \tag{1}$$

where D-target distance, c speed of light.

Therefore target distance measurement is the same as timing offset estimation.

Let's consider the effect of timing offset on the OFDM signal constellation which is the representation of a signal modulated by digital modulation scheme, such as 4-QAM or in particularly QPSK.

For a set of N modulated orthogonal subcarriers f_n the transmitted signal can be represented as

$$S_t(t) = \frac{1}{N}\sum_{n=0}^{N-1} \dot{F}_n \exp\{j2\pi f_n t\} \tag{2}$$

where $\dot{F}_n$ are modulated symbols. For QPSK modulation modulated symbols will be

$$\dot{F}_n = \exp\{j(2k+1)\}, k = 0,1,2,3 \tag{3}$$

Consequently transmitted OFDM signal symbols points in constellation will have correspondent positions:$\varphi_1 = \frac{\pi}{4}, \varphi_2 = \frac{3\pi}{4}, \varphi_3 = \frac{5\pi}{4}, \varphi_4 = \frac{7\pi}{4}$(Fig.1).

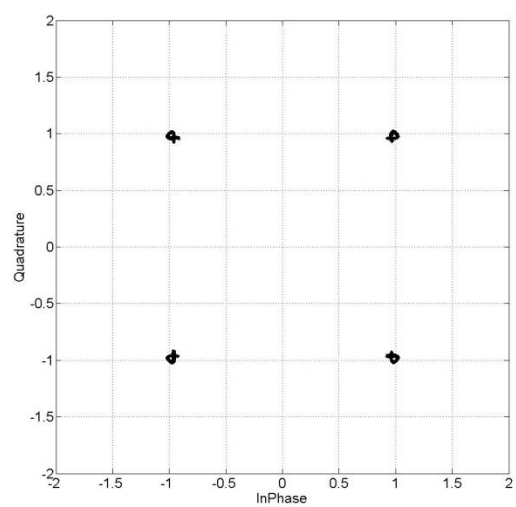


Figure 1 : OFDM transmitted signal constellation.

In communication systems phase difference of each two neighboring symbols could be $0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$. In such applications when it is necessary to solve time offset, this initial phase difference between each consecutive symbols must be prevented. One of the ways of preventing that initial shift is raising phase to the 4th power [6].

Taking into account only time delay effect from target the received echo signal $S_r(t)$ will be time shifted version of the transmitted signal.

$$S_r(t) = S_t(t-\tau) \tag{4}$$

Author: Institute of Radiophysics & Electronics of NAS of Armenia, Alikhanian brs, Ashtarak, Armenia. e- mail: arsen@irphe.am

© 2014 Global Journals Inc. (US)

So the received modulation symbols can be represented as

$$\dot{R_n} = \dot{F_n} \exp\{-j2\pi f_n \tau\} \quad (5)$$

As the phase of received symbol depended on subcarrier number, so with a large amount of subcarriers OFDM received symbols in constellation I/Q plane will spread all over plane in an interval $[0,2\pi]$(Fig.2).

To prevent this spreaded constellation, which doesn't give any opportunity to decide phase delay, we can simply take a divison of each consequitive symbols and make a new set of Q_k symbols.

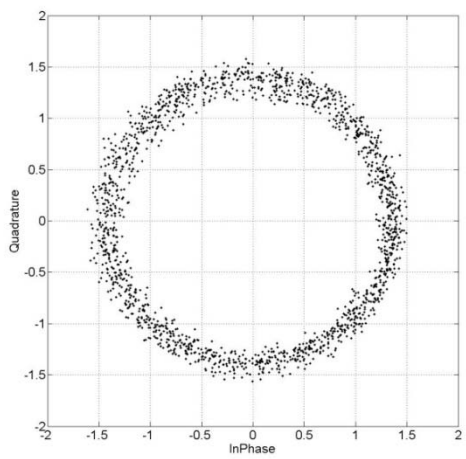


Figure 2 : OFDM received signal constellation consisting time delay.

$$Q_k = \frac{\dot{R_{n+1}}}{\dot{R_n}} = \frac{\dot{F_{n+1}}}{\dot{F_n}} \exp(-j2\pi f_{n+1}\tau + j2\pi f_n \tau) \quad (6)$$

where $k = 1,2,\ldots,N-1$. As we stated before, OFDM stransmitted signal symbols can get phase values $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}and\frac{7\pi}{4}$, it is obvious that

$$\frac{\dot{F_{n+1}}}{\dot{F_n}} = \exp\left(\mu \frac{\pi}{2}\right) \quad (7)$$

$\mu = 0,1,2,3$.From (6) and (7) new modified OFDM signal can be represented as

$$Q_k = \exp\left(\mu \frac{\pi}{2}\right) \exp\left(-j2\pi \Delta f \tau\right) \quad (8)$$

where $\Delta f = f_{n+1} - f_n$ is subcarrier spacing. Expression (8) shows that time delay is independent from subcarrier number. That's mean that it is the same on all modified OFDM symbols anymore and it can be easily calculated.

$$\Delta\varphi = 360 \cdot \Delta f \tau \quad (9)$$

Fig. 3.a shows modified QPSK transmitted signal constellation while in Fig 3.b it is received modified OFDM signal constellation.

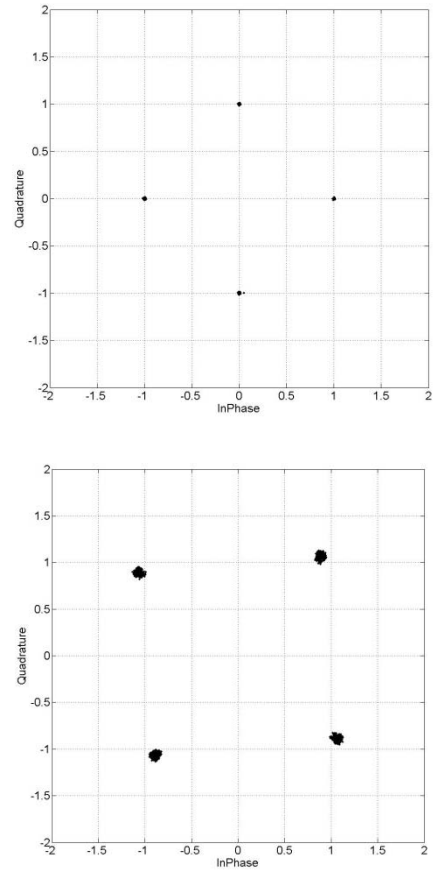


Figure 3 : (a) Modified OFDM transmitted signal constellation, (b) modified OFDM received signal constellation.

III. Distorted QPSK Mapped OFDM Radar Signal Time Delay Expected Value Calculation

In Fig. 3.b we can brightly see that even in all new modified OFDM symbols phase delay had the same impact, however there is still some distortion around the constellation poles. To prevent this distortion and calculate rotated angle more accurately, we simply have to extract an expected value of that rotated symbols (Fig. 4).

Simulations were done in Matlab environment with such parameterization: the carrier frequency $f_c = 24GHz$, OFDM symbol $T = 11\mu s$, guard interval $T_G = 1.375\mu s$. During the simulation our system generated a target with randomly selected actual distance $R_{act} = 248.1m$. Then from modified OFDM received signal we calculate rotated angle Fig 4. We get $\Delta\varphi_{meas} \approx 50.2^{\circ}$and consequently from (9) and (1) we get measured distance of the target from radar station $R_{meas} = 230m$. For absolute error we get

$$E_{\tau,abs} = |R_{act} - R_{means}| = 18.1m \quad (10)$$

And therefore relative percent error will be

© 2014 Global Journals Inc. (US)

$$E_{\tau,rel,\%} = \frac{E_{\tau,abs}}{R_{act}} \cdot 100\% \approx 7\% \qquad (11)$$

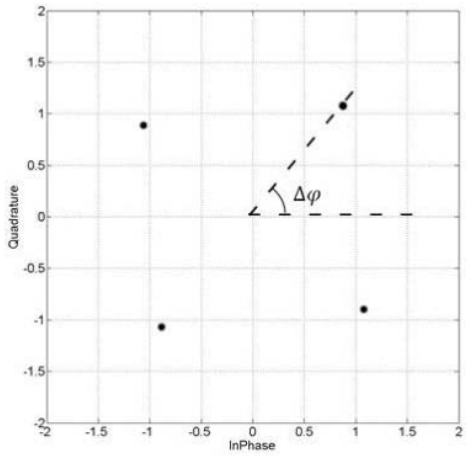


Figure 4 : The constellation of the modified OFDM received Q symbols estimated expected value.

IV. Conclusion

QPSK mapped OFDM modified signal processing let to solve target distance detection problem. Calculation process needs low computing resources because all processing could be done during one OFDM symbol.

References Références Referencias

1. Henrik Schulze, Christian Lueders, "Theory and Applications of OFDM and CDMA: Wideband Wireless Communications", Wiley, 2005.
2. J. Karlsson, O. Larsson, "SDR radar demonstrator using OFDM-modulation", Thesis, Linköping University, Sweden, September, 2009.
3. C.Sturm, E. Pancera,T. Zwick, W. "A Novel Approach To OFDM Radar Processing", 2009 IEEE Radar Conference, Pasadena, CA, pp 1 – 4.
4. Yoke Leen Sit, C. Sturm, T. Zwick, "Doppler Estimation in an OFDM Joint Radar and Communication System", German 2011 Microwave Conference (GeMIC), Darmstadt, pp 1 – 4.
5. A. Hakhoumian, Kh. Tovmasyan, E. Gabrielyan, "Doppler Shift Extraction from QPSK Mapped OFDM Signal Constellation", Global Journal of Science Frontier Research - Physics & Space Science, Volume 14, Issue 1, Version 1.0, 2014, pp. 39-43.
6. Leonard Joseph Cimini, Jr., Howell, Bruce Edwin McNair, Holmdel, "Method for Estimating Time and Frequency Offset in an OFDM System" US Patent 6891792 B1, May 10, 2005.

© 2014 Global Journals Inc. (US)

This page is intentionally left blank

© 2014 Global Journals Inc. (US)

Global Journal of Science Frontier Research: A
Physics and Space Science
Volume 14 Issue 5 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Some Exact Solutions of Non-Newtonian Fluid in Porous Medium with hall Effect Having Prescribed Vorticity Distribution Function

By Manoj Kumar
Ranchi College, India

Abstract- Two dimensional motion of an incompressible second grade fluid in a porous medium with Hall effects has been considered. Exact solutions are obtained via inverse method when vorticity distribution is proportional to stream function ψ, perturbed by a quadratic term.

Keywords: non-newtonian fluid, porous medium, hall effect, mhd, steady flow.

GJSFR-A Classification : FOR Code: 040405

SOMEEXACTSOLUTIONSOFNONNEWTONIANFLUID INPOROUSMEDIUMWITHHALLEFFECTHAVINGPRESCRIBEDVORTICITYDISTRIBUTIONFUNCTION

Strictly as per the compliance and regulations of :

© 2014. Manoj Kumar. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Some Exact Solutions of Non-Newtonian Fluid in Porous Medium with hall Effect Having Prescribed Vorticity Distribution Function

Manoj Kumar

Abstract- Two dimensional motion of an incompressible second grade fluid in a porous medium with Hall effects has been considered. Exact solutions are obtained via inverse method when vorticity distribution is proportional to stream function ψ, perturbed by a quadratic term.

Keywords: *non-newtonian fluid, porous medium, hall effect, mhd, steady flow.*

I. Introduction

The study of magneto hydrodynamic (MHD) fluid flows has been a subject of great interest because of their applications in widespread fields like magneto hydrodynamic generators, designing cooling systems with liquid metals, geothermal energy extraction, handling of biological fluids, flow of nuclear fuel slurries, electromagnetic propulsion and flow of blood. A number of researchers (Noreen Sher Akbar, S. Nadeem, R. Ul Haq and Z. H. Khan[1], Manoj Kumar and C.Thakur[2]) worked on some interesting problems in these directions.

But the above studies cannot be implemented in the case of ionized gases because in ionized gases (where the density is low and the magnetic field is strong), there is a conductivity normal to the free spiraling of electrons and ions about the magnetic lines of force before suffering collisions; also, a current is induced in a direction normal to both electric and magnetic fields. This is what we call the Hall Effects. This study has interesting features in problems of MHD generators, Hall accelerators and flight magneto hydrodynamics. N. Ahmad and K. Kr. Das[3], R. K. Deka[4], M.A.M. Abdeen et.al.[5], Haider Zaman et.al.[6] discussed the Hall effects in different situations.

The flows of non-newtonian fluid through porous media have gained a lot of importance in recent years. The flow through porous medium has lot of applications in engineering and science such as groundwater hydrology, petroleum engineering, reservoir engineering, chemical reactors, agricultural irrigation and drainage and recovery of crude oil from the pores of reservoir rocks.

Navier-Stokes equations are inherently non-linear partial differential equations has non general solution and only a small number of exact solutions have been found because the nonlinear inertial terms do not disappear automatically. Exact solutions are very important not only because they are solutions of some fundamental flows but also they serve as accuracy checks for experimental, numerical and asymptotic methods. So in order to perform this task one adopt transformations, inverse or semi-inverse method for the reformulation of equations in solvable form. Some researchers have used hodograph transformation[7,8] in order to linearize the system of governing equations and got some exact solutions. Some authors have used inverse method where some a priory condition is assumed about the flow variables and have found some exact solutions. This method has been extensively used by many researchers for the first grade fluid such as Chandna[9], M. Jamil et.al.[10,11] and others. In case of second grade fluid T. Hayat et.al.[12] applied this method to find some exact solutions. Benharbit and Siddiqui[13] used this method to study steady and unsteady second grade fluid flow by taking vorticity function of the form $\nabla^2\psi = k(\psi - Uy)$. Islam, Mohyuddin and Zhou[14] taking the same form of vorticity function studied the non-newtonian fluid in porous medium with Hall Effect. Further this method was also used by Chandna and Ukpong[15], A.M. Siddiqui et.al.[16], B.Singh and C. Thakur[17], Rana Khalid Naeem[18] , Manoj Kumar et.al.[19] in the study of second grade fluid flow.

In this paper we have studied second grade electrically conducting fluid flow in porous media with Hall Effect. The equations are modeled and solved by assuming the vorticity function proportional to the stream function perturbed by a quadratic stream $B(Cx+Dy+Ey^2)$. We have also found exact solution for finitely conducting steady and unsteady fluid flow.

II. Basic Flow Equation

The basic equations governing the motion of second grade electrically electrically conducting fluid flow in porous media with Hall Effect are given by :

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0 \tag{1}$$

Author: *Postgraduate Department of Physics, Ranchi College, Ranchi, India. e-mail: profmanoj@rediffmail.com*

© 2014 Global Journals Inc. (US)

$$\frac{\partial p^*}{\partial x}+\rho\left[\frac{\partial u}{\partial t}-v\omega\right]=\left(\mu+\alpha_1\frac{\partial}{\partial t}\right)\nabla^2 u-\frac{1}{K}\left(\mu+\alpha_1\frac{\partial}{\partial t}\right)u-\alpha_1 v\nabla^2\omega-\frac{\sigma B_0{}^2}{1+\varphi^2}(u-\varphi v), \quad (2)$$

$$\frac{\partial p^*}{\partial y}+\rho\left[\frac{\partial v}{\partial t}+u\omega\right]=\left(\mu+\alpha_1\frac{\partial}{\partial t}\right)\nabla^2 v-\frac{1}{K}\left(\mu+\alpha_1\frac{\partial}{\partial t}\right)v+\alpha_1 u\nabla^2\omega-\frac{\sigma B_0{}^2}{1+\varphi^2}(v+\varphi u), \quad (3)$$

where u=u(x, y, t), v=v(x, y, t) are the velocity components, p*=p*(x, y, t) is the pressure field, μ is the viscosity of the fluid, α_1 is the normal stress moduli, K is the permeability, $\varphi = \sigma B_0/en_e$ is the Hall parameter, σ is the electrical field conductivity, B_0 is the magnetic field, e is the electric charge and n_e is the number density of electrons.

In equations (2) – (3), the vorticity and the modified pressure are given respectively as

$$\omega=\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}, \quad (4)$$

$$p^*=\frac{\rho}{2}|\mathbf{v}|^2+p-\alpha_1\left[u\nabla^2 u+v\nabla^2 v+\frac{1}{4}|A_1|^2\right], \quad (5)$$

where,

$$|A_1|^2=4\left(\frac{\partial u}{\partial x}\right)^2+4\left(\frac{\partial v}{\partial y}\right)^2+2\left(\frac{\partial u}{\partial y}+\frac{\partial v}{\partial x}\right)^2 \quad (6)$$

These systems of equations have three unknowns u, v, and p. Once the velocity field is determined, the pressure field (5) can be found by integrating equations (2) and (3). The continuity equation (1) implies the existence of stream function ψ (x, y, t) such that

$$u=\frac{\partial\psi}{\partial y}, \quad v=-\frac{\partial\psi}{\partial x}. \quad (7)$$

Using integrability condition $\partial^2 p^*/\partial x\partial y = \partial^2 p^*/\partial y\partial x$, equation (2) and (3) reduces to

$$\rho\left[\frac{\partial}{\partial t}\left(\nabla^2\psi\right)-\left\{\psi,\nabla^2\psi\right\}\right]=\left(\mu+\alpha_1\frac{\partial}{\partial t}\right)\nabla^4\psi-\frac{1}{K}\left(\mu+\alpha_1\frac{\partial}{\partial t}\right)\nabla^2\psi-\alpha_1\left\{\psi,\nabla^4\psi\right\}-\frac{\sigma B_0^2}{1+\varphi^2}\nabla^2\psi. \quad (8)$$

In equation (8) if $K\to\infty$, and neglecting the Hall effects, we obtain the Benharbit and Siddiqui [13] case. If $K\to\infty$, $\alpha_1 = 0$, and neglecting Hall effects in equation (8), we recover the viscous case equations of Hui[20].

III. Exact Solutions

We shall investigate fluid motion for which vorticity distribution is proportional to the stream function perturbed by the quadratic term in x and y as given by

$$\nabla^2\psi=A\left[\psi-B\left(Cx+Dy+Ey^2\right)\right], \quad (9)$$

where A,B,C,D and E are constants but A≠0.The special case of A= 0 corresponds to an irrotational flow.

Introducing this value equation (8) reduces to

$$A\left(\rho-\alpha_1 A-\frac{\alpha_1}{K}\right)\psi_t+\rho BA\left\{(D+2Ey)\psi_x-\psi_y C\right\}-\alpha_1 A^2 B\left\{(D+2Ey)\psi_x-C\psi_y\right\}=$$

$$\mu A^2\left\{\psi-B\left(Cx+Dy+Ey^2\right)-\frac{2BE}{A}\right\}-\frac{\sigma B_0^2}{1+\varphi^2}A\left[\psi-B\left(Cx+Dy+Ey^2\right)\right]-\frac{\mu A}{K}\left\{\psi-B\left(Cx+Dy+Ey^2\right)\right\}$$

Letting $\psi=\Psi-B\left(Cx+Dy+Dy^2\right)$, the equation reduces to

$$A\left(\rho-\alpha_1 A-\frac{\alpha_1}{K}\right)\Psi_t+\left(\rho BA-\alpha_1 A^2 B\right)\left\{(D+2Ey)\Psi_x-C\Psi_y\right\}=\mu A^2\left\{\Psi-\frac{2BE}{A}\right\}-\frac{\mu A}{K}\Psi-\frac{\sigma B_0^2}{1+\varphi^2}A\Psi \quad (10)$$

Also,

$$\nabla^2\Psi=A\Psi-2BE. \quad (11)$$

In equation (10) if B=0, α_1=0 & K→∞ and neglecting the Hall effects we obtain the Taylor [20] case. If α_1=0, D=E=0, K→∞ and in the case of Hall effects equation (10) reduces to Hui[21] case. Also if K→∞ and neglecting the Hall effects we obtain the Benharbit and Siddiqui [13] case. Putting D=E=0, we reproduce the S. Islam et.al.[14] case.

Dividing equation (10) by A, we have

$$\left(\rho-\alpha_1 A-\frac{\alpha_1}{K}\right)\Psi_t+\left(\rho B-\alpha_1 AB\right)\left\{(D+2Ey)\Psi_x-C\Psi_y\right\}=\delta\left(\Psi-\frac{2\mu BE}{\delta}\right), \quad (12)$$

© 2014 Global Journals Inc. (US)

where,

$$\delta = \left\{ \frac{\mu(1+\varphi^2)(KA-1) - \sigma B_0^2 K}{K(1+\varphi^2)} \right\}. \quad (13)$$

a) Creeping Flow

For creeping flow, we have from equation (12),

$$\delta\left(\Psi - \frac{2\mu BE}{\delta}\right) = 0.$$

Since $\delta \neq 0$, we must have $\Psi = \frac{2\mu BE}{\delta}$.

Hence, $\psi = B(Cx + Dy + Ey^2) + \frac{2\mu BE}{\delta}$. (14)

The stream function (14) gives the exact solutions
u = B(D+2Ey),
v = -BC,

$$p = p_0 - \frac{\rho}{2}B^2(C^2+D^2) - 2\alpha_1 B^2 E^2 + B\left[2\rho BCE - \frac{\mu D}{K} - \frac{\sigma B_0^2}{1+\varphi^2}(D+\varphi C)\right]x -$$
$$2BE\left[\frac{\mu}{K} + \frac{\sigma B_0^2}{1+\varphi^2}\right]xy + B\left[\frac{\mu C}{K} - \frac{\sigma B_0^2}{1+\varphi^2}(\varphi D - C)\right]y - BE\left[\frac{\sigma B_0^2}{1+\varphi^2}\varphi\right]y^2.$$

b) Steady Flow

For steady flow we have $\Psi_t = 0$, so the system of equations (12) and (11) can be written as

$$(\rho B - \alpha_1 AB)\{(D+2Ey)\Psi_x - C\Psi_y\} = \delta\left(\Psi - \frac{2\mu BE}{\delta}\right), \quad (15)$$

& $$\nabla^2\Psi = A\Psi - 2BE, \quad (16)$$

We now introduce the following co-ordinate transformations

$$\Psi = \psi - B(Cx + Dy + Ey^2)$$
$$\xi = Cx + Dy + Ey^2$$
$$\eta = y$$

Equation (15) and (16) respectively reduces to

$$(\rho - \alpha_1 A)BC\Psi_\eta = \delta\left(\Psi - \frac{2\mu BE}{\delta}\right), \quad (17)$$

$$\{C^2 + (D+2E\eta)^2\}\Psi_{\xi\xi} + 2(D+2E\eta)\Psi_{\xi\eta} + 2E\Psi_\xi + \Psi_{\eta\eta} = \delta\left(\Psi - \frac{2\mu BE}{\delta}\right). \quad (18)$$

Case I :

One of the solution of equation (17), when, $(\rho - \alpha_1 A) = 0$, is

$$\Psi = \frac{2\mu BE}{\delta}.$$

Hence, $\psi = B(Cx + Dy + Ey^2) + \frac{2\mu BE}{\delta}$.

The stream function gives the exact solutions
u = B(D+2Ey),
v = -BC,

$$p = p_0 - \frac{\rho}{2}B^2(C^2+D^2) - 2\alpha_1 B^2 E^2 + B\left[2\rho BCE - \frac{\mu D}{K} - \frac{\sigma B_0^2}{1+\varphi^2}(D+\varphi C)\right]x -$$
$$2BE\left[\frac{\mu}{K} + \frac{\sigma B_0^2}{1+\varphi^2}\right]xy + B\left[\frac{\mu C}{K} - \frac{\sigma B_0^2}{1+\varphi^2}(\varphi D - C)\right]y - BE\left[\frac{\sigma B_0^2}{1+\varphi^2}\varphi\right]y^2.$$

Case II :

When $(\rho - \alpha_1 A) \neq 0$, solving equation (17) (By variable separable method) we get

$$\Psi = \frac{2\mu BE}{\delta} + g(\xi)e^{\lambda\eta}, \quad (19)$$

where, $$\lambda = \left\{ \frac{\mu(1+\varphi^2)(KA-1) - \sigma B_0^2 K}{K(1+\varphi^2)(\rho - \alpha_1 A)BC} \right\}. \quad (20)$$

To find g(ξ), we substitute equation (19) in to equation (18) and get

$$e^{\lambda\eta}\left[\{C^2 + (D+2E\eta)^2\}g''(\xi) + \{2\lambda(D+2E\eta) + 2E\}g'(\xi) + (\lambda^2 - \delta)g(\xi)\right] = 0. \quad (21)$$

Since ξ, η are independent variables, we must have two cases $E = 0$, $g'(\xi) = 0$.

Case IIa: In this case $E = 0$ and equation (21) becomes

$$(C^2 + D^2)g''(\xi) + 2\lambda Dg'(\xi) + (\lambda^2 - \delta)g(\xi) = 0 \quad (22)$$

© 2014 Global Journals Inc. (US)

The solution of (22) combined with equation (19) and also using $\Psi = \psi - B\left(Cx + Dy + Ey^2\right)$, $\xi = Cx + Dy + Ey^2$, $\eta = y$ and taking $E = 0$, we obtain the stream function as :

$$\psi(x,y) = B(Cx+Dy) + A_1 e^{m_1(Cx+Dy)+\lambda y} + A_2 e^{m_2(Cx+Dy)+\lambda y} \text{ for } M > 0, \quad (23.1)$$

$$= B(Cx+Dy) + \left(B_1 + B_2(Cx+Dy)\right)e^{m_3(Cx+Dy)+\lambda y} \text{ for } M = 0, \quad (23.2)$$

$$= B(Cx+Dy) + C_1 e^{\alpha(Cx+Dy)+\lambda y}\cos\left(\beta(Cx+Dy)+C_2\right) \text{ for } M < 0, \quad (23.3)$$

where,

$$M = \lambda^2 D^2 - \left(C^2 + D^2\right)\left(\lambda^2 - \delta^2\right),$$

$$m_1 = \frac{-\lambda D + \sqrt{M}}{\left(C^2 + D^2\right)}, m_2 = \frac{-\lambda D - \sqrt{M}}{\left(C^2 + D^2\right)}, m_3 = \frac{-\lambda D}{\left(C^2 + D^2\right)},$$

$$\alpha = \frac{-\lambda D}{\left(C^2 + D^2\right)}, \beta = \frac{\sqrt{M}}{\left(C^2 + D^2\right)}.$$

A_1, A_2, B_1, B_2, C_1 and C_2 are arbitrary constants.

It is noted that the results of S. Islam et.al. (2008) can be recovered as special case by taking C=0 and appropriately choosing the value of constants in the present result.

The exact solution given by equation (23.1) when $M > 0$

$$u = \left[BD + A_1(m_1 D + \lambda)e^{m_1 Cx + (m_1 D + \lambda)y} + A_2(m_2 D + \lambda)e^{m_2 Cx + (m_2 D + \lambda)y}\right] \quad (24.1)$$

$$v = -\left[BC + A_1 m_1 C e^{m_1 Cx + (m_1 D + \lambda)y} + A_2 m_2 C e^{m_2 Cx + (m_2 D + \lambda)y}\right]. \quad (24.2)$$

The exact solution given by equation (23.2) when $M = 0$

$$u = \left[BD + B_2 D e^{m_3 Cx + (m_3 D + \lambda)y} + \left\{B_1 + B_2(Cx + Dy)\right\}(m_3 D + \lambda)e^{m_2 Cx + (m_2 D + \lambda)y}\right]. \quad (25.1)$$

$$v = -\left[BC + B_2 C e^{m_3 Cx + (m_3 D + \lambda)y} + \left\{B_1 + B_2(Cx + Dy)\right\}m_3 C e^{m_2 Cx + (m_2 D + \lambda)y}\right] \quad (25.2)$$

And equation (23.3) gives the exact solution for $M < 0$

$$u = \left[BD + C_1(\alpha D + \lambda)e^{\alpha Cx + (\alpha D + \lambda)y}\cos\left(\beta(Cx + Dy) + C_2\right) + C_1\beta e^{\alpha Cx + (\alpha D + \lambda)y}\sin\left(\beta(Cx + Dy) + C_2\right)\right]. \quad (26.1)$$

$$v = -\left[BC + C_1\alpha C e^{\alpha Cx + (\alpha D + \lambda)y}\cos\left(\beta(Cx + Dy) + C_2\right) - C_1\beta e^{\alpha Cx + (\alpha D + \lambda)y}\sin\left(\beta(Cx + Dy) + C_2\right)\right]. \quad (26.2)$$

In all the above cases p can be calculated by putting the value of u and v in equation (5).

Case IIb: In this case we take $g'(\xi) = 0$, which implies $g(\xi) = a_\circ$, where $a_\circ \neq 0$ is an arbitrary constant and $\delta = \lambda^2$, using this in equation (19), $\Psi = \psi - B\left(Cx + Dy + Ey^2\right)$ and $\eta = y$ we get stream function $\psi = \frac{2\mu BE}{\lambda^2} + B\left(Cx + Dy + Ey^2\right) + a_0 e^{\lambda}$, (27)

Hence, we get the exact solution as:

$$u = \left[B(D + 2Ey) + a_0 \lambda e^{\lambda y}\right],$$

$$v = -BC, \quad (28)$$

Also p can be calculated by putting the value of u and v in equation (5).

Discussion

Solution (23.1) represents a uniform flow in (x, y) plane, in the region $y > 0$, perturbed by a part which grows and decays exponentially as y increases if $\lambda \rangle 0$ and $\lambda \langle 0$, respectively. The reverse holds true for the region $y < 0$, and the flow is exponential in x and y in both cases. The solution (23.2) can be used to describe, in $y > 0$, a uniform flow plus a different type of perturbation which again grows and decays as y increases in the same as in (23.2). Solution (23.3) represents a uniform flow with a perturbation part which is periodic in x and y and grows and decays exponentially as y increases, respectively, when $\lambda \rangle 0$ and $\lambda \langle 0$ for the region $y > 0$. A similar description can be given for a flow in $y < 0$.

c) Unsteady Flow

By rewriting equation (12) in the form

$$\frac{\partial \Psi}{\partial t} + U_1\left\{(D + 2Ey)\frac{\partial \Psi}{\partial x} - C\frac{\partial \Psi}{\partial y}\right\} = \gamma\left(\Psi - \frac{2\mu BE}{\delta}\right), \quad (29)$$

© 2014 Global Journals Inc. (US)

where,

$$\gamma = \left\{ \frac{\mu\left(1+\varphi^2\right)\left(KA-1\right)-\sigma B_0^2 K}{K\left(1+\varphi^2\right)\left(\rho-\alpha_1 A-\alpha_1/K\right)} \right\},$$

$$U_1 = \frac{\left(\rho B-\alpha_1 AB\right)}{\left(\rho-\alpha_1 A-\alpha_1/K\right)} \quad . \qquad (30)$$

Solving equation (29) by variable separable method we get

$$\Psi = F(X,Y)e^{\gamma t} + \frac{2\mu BE}{\delta}, \qquad (31)$$

where F(X, Y) is an unknown function to be determined and

$$X = x - U_1(D+2Ey)t,$$
$$Y = y + U_1 Ct. \qquad (32)$$

Putting the value of Ψ in equation (16)

$$\nabla^2\left[F(X,Y)e^{\gamma t}+\frac{2\mu BE}{\delta}\right] = A\left[F(X,Y)e^{\gamma t}+\frac{2\mu BE}{\delta}\right]-2BE,$$

$$F_{XX}+F_{YY} = AF(X,Y)+2EB\left(\frac{\mu A}{\rho}-1\right)e^{-\gamma t}. \qquad (33)$$

Plane wave solution of Helmholtz equation (33) exist in the form

$$F(X,Y) = g(\xi),\ \xi = X\cos\theta + Y\sin\theta,\ -\pi \le \theta \le \pi \qquad (34)$$

Using equation (34) in equation (33) we obtain

$$g''(\xi) - Ag(\xi) = 2EB\left(\frac{\mu A}{\delta}-1\right)e^{-\gamma t} \quad . \qquad (35)$$

Following cases arises:

Case I: When A=0

$$g(\xi) = -2EBe^{-\gamma t}\frac{\xi^2}{2} + C_1\xi + C_2\ , \qquad (36)$$

where C_1 and C_2 are arbitrary constants depending on θ.

A combination of (36) with (34) gives

.

This relation with (32),(31) and $\Psi = \psi - B\left(Cx+Dy+Ey^2\right)$ gives stream function as

$$\psi = -EB\xi^2 + \left(C_1\xi + C_2\right)e^{\gamma t} + \frac{2\mu BE}{\delta} + B\left(Cx+Dy+Ey^2\right), \qquad (37)$$

where,

$$\xi = \left\{x - U_1\left(D+2Ey\right)t\right\}\cos\theta + \left\{y + U_1 Ct\right\}\sin\theta\ ,$$

$$\gamma = \frac{-\mu\left(1+\varphi^2\right)-\sigma B_0^2 K}{K\left(1+\varphi^2\right)\left(\rho-\alpha_1/K\right)},$$

$$U_1 = \frac{\rho B}{\left(\rho-\alpha_1/K\right)}.$$

Hence we get exact solutions as

$$u = -2EB\xi\left(-U_1 2Et\cos\theta + \sin\theta\right) + C_1\left(-U_1 2Et\cos\theta + \sin\theta\right) + B\left(D+2Ey\right),$$

$$v = -2EB\xi\cos\theta - C_1 e^{\gamma t}\cos\theta - BC.$$

P can be calculated by putting the value of u and v in equation (5).

Case II: If $A = \Omega^2 \rangle 0$ then solution of equation (35) is

$$g(\xi) = D_1 e^{\Omega\xi} + D_2 e^{-\Omega\xi} + 2EB\left(\Omega^2-1\right)e^{-\gamma t}\left(\frac{\xi^2}{2}-\frac{\Omega^2\xi^4}{24}\right), \qquad (38)$$

where D_1 and D_2 are arbitrary constants depending on θ.

Combining (38) with equation (34)

$$F(X,Y) = D_1 e^{\Omega\xi} + D_2 e^{-\Omega\xi} + 2EB\left(\Omega^2-1\right)e^{-\gamma t}\left(\frac{\xi^2}{2}-\frac{\Omega^2\xi^4}{24}\right).$$

Putting this value in (31) and using $\Psi = \psi - B\left(Cx+Dy+Ey^2\right)$ we get stream function as

$$\psi = \left(D_1 e^{\Omega\xi} + D_2 e^{-\Omega\xi}\right)e^{\gamma t} + \frac{1}{12\delta}EB\left(\Omega^2-1\right)\left(12\xi^2-\Omega^2\xi^4\right) + \frac{2\mu BE}{\delta} + B\left(Cx+Dy+Ey^2\right),$$

where,

$$\xi = \left\{x - U_1\left(D+2Ey\right)t\right\}\cos\theta + \left\{y + U_1 Ct\right\}\sin\theta,$$

$$\gamma = \frac{\mu\left(1+\varphi^2\right)\left(K\Omega^2-1\right)-\sigma B_0^2 K}{K\left(1+\varphi^2\right)\left(\rho-\alpha_1\Omega^2-\alpha_1/K\right)},$$

$$U_1 = \frac{\rho B - \alpha_1\Omega^2 B}{\left(\rho-\alpha_1\Omega^2-\alpha_1/K\right)}.$$

Hence we get velocity components as

© 2014 Global Journals Inc. (US)

$$u=\left(D_1e^{\Omega\xi}-D_2e^{-\Omega\xi}\right)e^{\gamma t}\Omega\left(-U_1 2Et\cos\theta+\sin\theta\right)+\frac{1}{12}EB\left(\Omega^2-1\right)\left(24\xi-4\Omega^2\xi^3\right)\left(-U_1 2Et\cos\theta+\sin\theta\right)+B\left(D+2Ey\right)$$

$$v=-\left(D_1e^{\Omega\xi}-D_2e^{-\Omega\xi}\right)e^{\gamma t}\Omega\cos\theta-\frac{1}{12}EB\left(\Omega^2-1\right)\left(24\xi-4\Omega^2\xi^3\right)\cos\theta-BC.$$

Also p can be calculated using equation (5).

Case III: If $A=-\Omega^2\langle 0$, then the general function for $g(\xi)$ is

$$g(\xi)=B_1\cos\Omega\left(\xi+B_2(\theta)\right)+\left(\frac{\xi^2}{2}+\frac{\Omega^2\xi^4}{24}\right)2EB\left(-\Omega^2-1\right)e^{-\gamma t}, \tag{39}$$

where B_1 and B_2 are arbitrary constants depending on the parameter θ.

Combining equation (39) with equation (34) we get

$$F(X,Y)=B_1\cos\Omega\left(\xi+B_2(\theta)\right)+\left(\frac{\xi^2}{2}+\frac{\Omega^2\xi^4}{24}\right)2EB\left(-\Omega^2-1\right)e^{-\gamma t}$$

Putting this value in equation (31) and using $\Psi=\psi-B\left(Cx+Dy+Ey^2\right)$ we get stream function as

$$\psi=\left\{B_1\cos\Omega\left(\xi+B_2(\theta)\right)\right\}e^{\gamma t}+\frac{1}{12\delta}EB\left(12\xi^2+\Omega^2\xi^4\right)\left(-\Omega^2-1\right)+\frac{2\mu BE}{}+B\left(Cx+Dy+Ey^2\right),$$

where,

$$\xi=\left\{x-U_1\left(D+2Ey\right)t\right\}\cos\theta+\left\{y+U_1Ct\right\}\sin\theta,$$

$$\gamma=\frac{\mu\left(1+\varphi^2\right)\left(-K\Omega^2-1\right)-\sigma B_0^2K}{K\left(1+\varphi^2\right)\left(\rho+\alpha_1\Omega^2-\alpha_1/K\right)},$$

$$U_1=\frac{\rho B+\alpha_1\Omega^2B}{\left(\rho+\alpha_1\Omega^2-\alpha_1/K\right)}.$$

Hence we get exact solutions as

$$u=-\Omega\sin\theta\left\{B_1\cos\Omega\left(\xi+B_2(\theta)\right\}e^{\gamma t}+\frac{1}{12}EB\left(24\xi+4\Omega^2\xi^3\right)\left(-\Omega^2-1\right)\left(-U_{12}Et\cos\theta+\sin\theta\right)+B\left(D+2Ey\right),$$

$$v=-\Omega\cos\theta\left\{B_1\cos\Omega\left(\xi+B_2(\theta)\right\}e^{\gamma t}-\frac{1}{12}EB\left(24\xi+4\Omega^2\xi^3\right)\left(-\Omega^2-1\right)\cos\theta+BC$$

P can be calculated by putting the values of u and v in equation (5).

IV. Conclusion

In this paper we have found the exact solutions of the governing equations of incompressible second grade fluid in a porous medium with the Hall currents under the assumption that vorticity distribution is proportional to the stream function perturbed by a quadratic term. We recovered the solutions of Benharbit and Siddiqui[13], Hui[21] and Islam, Mohyuddin and Zhou[14] in limiting cases if the corresponding conditions are applied. Our solutions are compatible in a limiting case with those of Benharbit and Siddiqui, Hui and Islam et.al. Expressions for streamlines, velocity components and pressure fields are defined in each case. Our solutions are more general and several results of various authors can be recovered in a limiting case.

References Références Referencias

1. AKBAR,N.S., NADEEM, S., HAQ, R.UI &KHAN, Z.H. (2013), Numerical solution of magnetohydro dynamic boundary layer flow of tangent hyperbolic fluid towards stretching sheet, *Indian J. Phys.* 87(11). P. 1121-1124.
2. KUMAR, MANOJ & THAKUR, C. (2012), On steady plane MHD viscous fluid flow through porous Media,*IJMA* 3(6). P. 2438-2444.
3. AHMAD, N. & DAS, K. Kr.(2013),Hall effect on transient MHD flow past an impulsively started vertical plate in a porous media with ramped

© 2014 Global Journals Inc. (US)

temperature, rotation and heat absorption, *Applied Mathematical Sciences* **7.** P. 2525-2535.

4. DEKA,R.K.(2008), Hall effects on MHD flow past an accelerated plate, *Theoret. Appl. Mech.* **35(4)**. P. 333-346.
5. ABDEEN,M. A. M., ATTIA, H. A., ABBAS, W., et.al (2013),Effectiveness of porosity on transient generalised coquette flow with Hall effect and variable properties under exponential decaying pressure gradient, *Indian J. Phys.* **87(8)**. P.767-775.
6. ZAMAN, H., SOHAIL, A., ALI, A., ABBAS, T. (2014), Effect of Hall current on flow of unsteady MHD axisymmetric second grade fluid with suction and blowing over an exponentially stretching sheet, *Open Journal of Modelling and Simulation* **2.** P. 23-33.
7. KUMAR, MANOJ & THAKUR, C.(2009), Hodograph transformation methods in MHD non-Newtonian fluids. *Bull. Cal. Math. Soc.* **101(5)**. P. 515-530.
8. KUMAR MANOJ, SIL SAYANTAN & THAKUR, C. (2013), Hodograph transformation in constantly inclined two phase MFD flows through porous media. *IJMA* **4(7)**. P. 42-47.
9. CHANDNA, O.P. & OKU-UKPONG, E.O. (1994), Flows of chosen vorticity function-Exact solutions of the Navier-Stokes equations, *Int. J. Math. and Math. Sci.* **17**(1). P. 155-164.
10. JAMIL, M.,KHAN, N.A., MAHMOOD, A. et.al(2010), Some exact solutions for the flow of a Newtonian fluid with heat transfer via prescribed vorticity, *Journal of Prime Research in Mathematics* **6.** P. 38-55.
11. JAMIL, M. (2010), A class of exact solutions to Navier-Stokes equations for the given vorticity, *International Journal of Nonlinear Science* **9(3)**. P. 296-304.
12. HAYAT, T., NAEEM, I., AYUB, M. et.al (2009), Exact solutions of second grade aligned MHD fluid with prescribed vorticity, *Nonlinear Analysis:Real World Applications* **.10.** P. 2017-2126.
13. BENHARBIT, A.M. & SIDDIQUI, A.M.(1992), Certain solutions of the equations of planer motion of a second grade fluid for steady and unsteady cases, *Acta Mechanica.* **94**. P. 85.
14. ISLAM, S., MOHYUDDIN,M.R. & ZHOU, C.Y. (2008), Few exact solutions of non-newtonian fluid in porous medium with Hall effect, *Jour. Of Porous Media* **11(7)** XXX XXX . P.1-12.
15. CHANDNA, O.P. & OKU-UKPONG, E.O. (1994) Unsteady second grade aligned MHD fluid flow, *Acta Mechanica* **107.** P. 77-91.
16. SIDDIQUI, A.M., MOHYUDDIN,M.R., HAYAT, T. & ASGHAR, S. (2003), Some more inverse solutions for steady flows of asecond grade fluid, *Arch. Mech.* **55(5-6)**. P.373-383.
17. SINGH, B. & THAKUR, C.(2002),An exact solution of plane unsteady MHD non-newtonian fluid flows, *Indian J. pure appl. Math.* **33**(7). P. 993-1001.
18. NAEEM, RANA KHALID (2011),Exact solutions of a second-grade fluid via inverse method,Journal of Basic and Applied Sciences, *Journal of Basic and Applied Sciences* **7(1)**. P. 27-31.
19. KUMAR MANOJ, SIL SAYANTAN & THAKUR, C. (2013), Solutions of unsteady second grade aligned MHD fluid flow having prescribed vorticity distribution function, *Bull. Cal. Math. Soc.* **105(6)**. P. 445-462.
20. TAYLOR,G.I. (1923), On the decay of vortices in a viscous fluid, Phil. Mag., *Phil. Mag.* **46(6).** P. 671-674.
21. HUI,W. H.(1987), Exact solutions of unsteady two-dimensional Navier-Stokes equations, *ZAMP* **24**. P. 689-702.

© 2014 Global Journals Inc. (US)

This page is intentionally left blank

© 2014 Global Journals Inc. (US)

Global Journal of Science Frontier Research: A
Physics and Space Science
Volume 14 Issue 5 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Search for Four-Charged Lepton from Decay Doubly-Charged Higgs Pair Production at the Hadron Colliders

By Nady Bakhet, Maxim Yu. Khlopov & Tarek Hussein

Cairo University, Egypt

Abstract- The Left-Right symmetry Model (LRSM) is an extension of the Standard Model based on the gauge symmetry group SU(3)C × SU(2)L × SU(2)R × U(1)B-L predicts by existence new particles like doubly-charged Higgs boson, W' new charged boson, Z' new neutral boson and heavy neutrinos. In this work we present an analysis for production four-charged lepton in final state produced via decaying a pair of doubly-charged Higgs boson in the context of LRSM by using Monte Carlo simulation Techniques at both the Large Hadron Collider (proton-proton collisions) and the Fermilab Tevatron Collider (proton-antiproton collisions). In this analysis we assume that the branching ratio of decay channels of left-handed or right-handed doubly-charged Higgs boson BR ($H^{\pm\pm} \rightarrow \ell^{\pm}\ell^{\pm} = 100\%, \ell = e^{\pm}, \mu^{\pm}, \tau^{\pm}$). We carry out a Monte Carlo study of the (Left or Right) doubly charged Higgs pair production and decay to four-charged lepton via the process $pp(\bar{p}) \rightarrow H^{\pm\pm}H^{\pm\pm} \rightarrow \ell^{\pm}\ell^{\pm}\ell^{\pm}\ell^{\pm},\ \ell = e^{\pm}, \mu^{\pm}, \tau^{\pm}$. From Monte Carlo simulation level the doubly-charged Higgs may be found at the LHC or at the Tevatron in the mass range up to 800 GeV.

Keywords: LHC, tevatron, left-right model, doubly charged higgs, monte carlo simulation.

GJSFR-A Classification : FOR Code: 029999

SEARCHFORFOURCHARGEDLEPTONFROMDECAYDOUBLY-CHARGEDHIGGSPAIRPRODUCTIONATTHEHADRONCOLLIDERS

Strictly as per the compliance and regulations of :

© 2014. Nady Bakhet, Maxim Yu. Khlopov & Tarek Hussein. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Search for Four-Charged Lepton from Decay Doubly-Charged Higgs Pair Production at the Hadron Colliders

Nady Bakhet [α], Maxim Yu. Khlopov [σ] & Tarek Hussein [ρ]

Abstract- The Left-Right symmetry Model (LRSM) is an extension of the Standard Model based on the gauge symmetry group SU(3)C × SU(2)L × SU(2)R × U(1)B-L predicts by existence new particles like doubly-charged Higgs boson, W' new charged boson, Z' new neutral boson and heavy neutrinos. In this work we present an analysis for production four-charged lepton in final state produced via decaying a pair of doubly-charged Higgs boson in the context of LRSM by using Monte Carlo simulation Techniques at both the Large Hadron Collider (proton-proton collisions) and the Fermilab Tevatron Collider (proton-antiproton collisions). In this analysis we assume that the branching ratio of decay channels of left-handed or right-handed doubly-charged Higgs boson BR ($H^{\pm\pm} \rightarrow \ell^{\pm}\ell^{\pm} = 100\%, \ell = e^{\pm}, \mu^{\pm}, \tau^{\pm}$). We carry out a Monte Carlo study of the (Left or Right) doubly charged Higgs pair production and decay to four-charged lepton via the process $pp(\bar{p}) \rightarrow H^{\pm\pm}H^{\pm\pm} \rightarrow \ell^{\pm}\ell^{\pm}\ell^{\pm}\ell^{\pm},\ \ell = e^{\pm}, \mu^{\pm}, \tau^{\pm}$. From Monte Carlo simulation level the doubly-charged Higgs may be found at the LHC or at the Tevatron in the mass range up to 800 GeV.

Keywords: LHC, tevatron, left-right model, doubly charged higgs, monte carlo simulation.

I. Introduction

Doubly-charged Higgs bosons $H^{\pm\pm}$ appear in several extensions beyond the Standard Model, in particular, in Left-Right Symmetric Model (LRSM) [1], in Higgs triplet models [2] and in Little-Higgs models [3]. In addition to the neutral Higgs boson, single charged and doubly-charged Higgs bosons are part of Higgs triplet. Both Higgs bosons may be reconstructed giving two like-charge pairs of leptons with similar invariant mass. Left-Right Symmetric Model predicts the appearance of a left- and a right-handed Higgs triplet both with hypercharge $|Y| = 2$. In this work we search for doubly-charged Higgs bosons decaying to pairs of electrons and/or muons. Pairs of isolated, high transverse momentum leptons with the same electric charge ($e^{\pm}e^{\pm}, \mu^{\pm}\mu^{\pm}, e^{\pm}\mu^{\pm}$) are selected, and their invariant mass distribution is searched for a narrow resonance. We use Monte Carlo (MC) event generator PYTHIA8 [4] for the simulation of signal and background processes either to generate a given hard interaction at leading order (LO), or for the simulation of showering and hadronization. Also we use MADGRAPH5 [5] to generate diboson and Drell–Yan events. The LRSM predicts dominant decay modes to like-charge lepton pairs $H^{\pm\pm} \rightarrow \ell^{\pm}\ell^{\pm}$. Pairs of doubly-charged Higgs bosons can be produced through the Drell-Yan process $(\bar{P}) \rightarrow \gamma^{*}/Z \rightarrow H^{--}H^{++}$. The observation of a doubly-charged scalar particle would establish the type II seesaw mechanism as the most promising framework for generating neutrino masses. The minimal type II seesaw model [6] is realized with an additional scalar field that is a triplet under SU(2)L and carries U(1)Y hypercharge Y = 2. The triplet contains a doubly-charged component $H^{\pm\pm}$, a singly-charged component $H^{\pm\pm}$ and a neutral component H^{0}. The masses of doubly-charged Higgs bosons are constrained depending on the branching ratio into these leptonic final states. A $H^{\pm\pm}$ particle can also occur as a singlet as proposed in the Zee-Babu model [7], where it is postulated for the purpose of generating Majorana neutrino masses. Assuming pair production, coupling to left-handed fermions, and a branching ratio of 100% for each final state.

II. The Results

The process $pp(\bar{p}) \rightarrow H^{++}H^{--} \rightarrow \ell_{\alpha}^{+}\ell_{\beta}^{+}\ell_{\lambda}^{-}\ell_{\delta}^{-}$ is simulated using PYTHIA8 [8] event generator for Left-Right Symmetric model new particle $H^{\pm\pm}$. In order to obtain the full signal cross-section, a cut which PYTHIA applies by default on the transverse momentum P_T of the lepton. Left-handed and Right-handed states are distinguished through their decays into left-handed or right-handed leptons. The cross section also depends on the hypercharge Y of the $H^{\pm\pm}$ boson.

a) *Production Cross Section of $H^{\pm\pm}$ at the LHC and the Tevatron*

Figure (1-a) shows the production cross section of doubley-charged Higgs boson pair production and both of H^{++} and H^{--} decay to $e^{+}e^{+}$ and $e^{-}e^{-}$ respectively. In this simulation we off all decay channel of $H^{\pm\pm}$, only decays to $e^{+}e^{+}$ and $e^{-}e^{-}$ means BR ($H^{\pm\pm} \rightarrow e^{\pm}e^{\pm}$) = 1 and we calculate the production and decay of doubly charge Higgs boson (Right-handed and Left handed) at center of mass energies of the

Author α ρ: Department of Physics, Cairo University, Giza, Egypt.
e-mail: nady.bakhet@cern.ch
Author α: Egyptian Network of High Energy Physics – ASRT-Egypt.
Author σ: APC Laboratory, IN2P3/CNRS, Paris, France.
Author σ: National Research Nuclear University "MEPHI" (Moscow Engineering Physics Institute) – Russia.

© 2014 Global Journals Inc. (US)

Large Hadron Collider (proton-proton collision) $\sqrt{s}$ = 7,8,10 and 12 TeV in addition to the production and decay at the Tevatron (proton- antiproton collision) $\sqrt{s}$ = 1.96 TeV, the mass values range here form 200 GeV to 1 TeV . From the Figure we see that the value of production decrease with increase the mass value at both the LHC and the Tevatron for right handed and left-handed doubly charged Higgs boson also the value of cross section at the Tevatron is small than at the LHC which increases with increasing the center of mass energy from 7 TeV to 12 TeV. In order to select events from well-measured collisions, the events are preselected by requiring at least two final-state light leptons, with pT > 30 GeV. If pairs of light leptons with invariant mass less than 12 GeV are reconstructed, neither of the particles is considered in the subsequent steps of the analysis. In Figures (1, b-c) show the production cross section of doubly-charged Higgs boson and decay to $e^{\pm}e^{\pm}, \mu^{\pm}\mu^{\pm}$ *and* $e^{\pm}\mu^{\pm}$ respectively, here the center of mass energy for the LHC is 14 TeV and at the Tevatron is 1.96 TeV we calculated for left-handed and right-handed doubly-charged Higgs boson in Left-Right Symmetric Model .

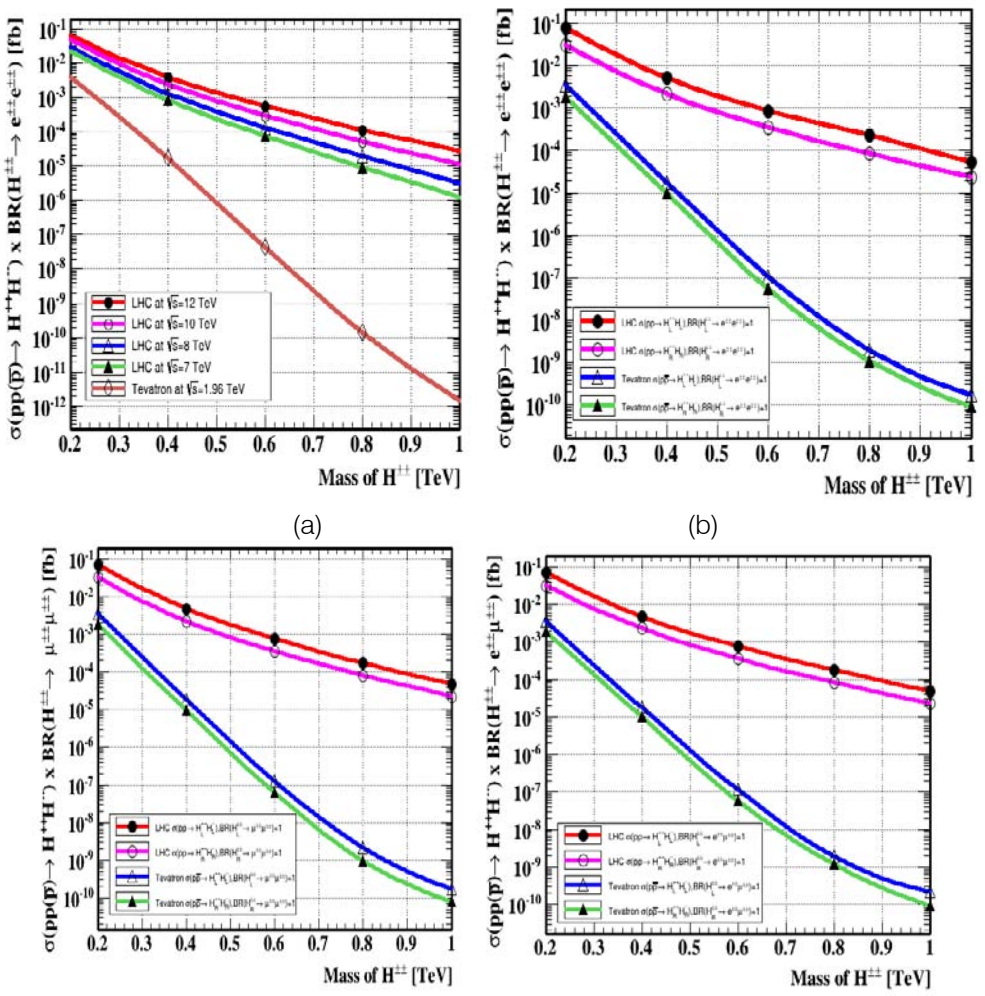


Figure 1 : The production cross section times branching ratio for pair production of $H_L^{\pm\pm}$ or $H_R^{\pm\pm}$ bosons at the LHC and the Tevatron decays to (a) $e^{\pm}e^{\pm}$ at the LHC energies 7,8,10 and 12 TeV and (b) $e^{\pm}e^{\pm}$ (c) $\mu^{\pm}\mu^{\pm}$ (d) $e^{\pm}\mu^{\pm}$ at 14 TeV (in the Left-Right Symmetric Model using Pythia8 and MadGraph5).

The main production mechanisms of $H^{\pm\pm}$ bosons at hadron colliders are pair roduction via an s-channel Z boson or photon exchange and associated production with a $H^{\pm\pm}$ boson via a W-boson exchange but in our work we study the production of $H^{\pm\pm}$ in concept of Left-Right Symmetric Model (LRSM) .

At D0 detector at the Fermilab Tevatron Collider. In the absence of an excess above the standard model background, lower mass limits M($H_L^{\pm\pm}$) >150 GeV/c2 and M($H_R^{\pm\pm}$) >127 GeV/c2. For left-handed and right-handed doubly-charged Higgs bosons assuming a 100% branching ratio into leptons BR($H^{\pm\pm} \rightarrow \ell^{\pm}\ell^{\pm} = 100\%, \ell = e^{\pm}, \mu^{\pm}, \tau^{\pm}$).

© 2014 Global Journals Inc. (US)

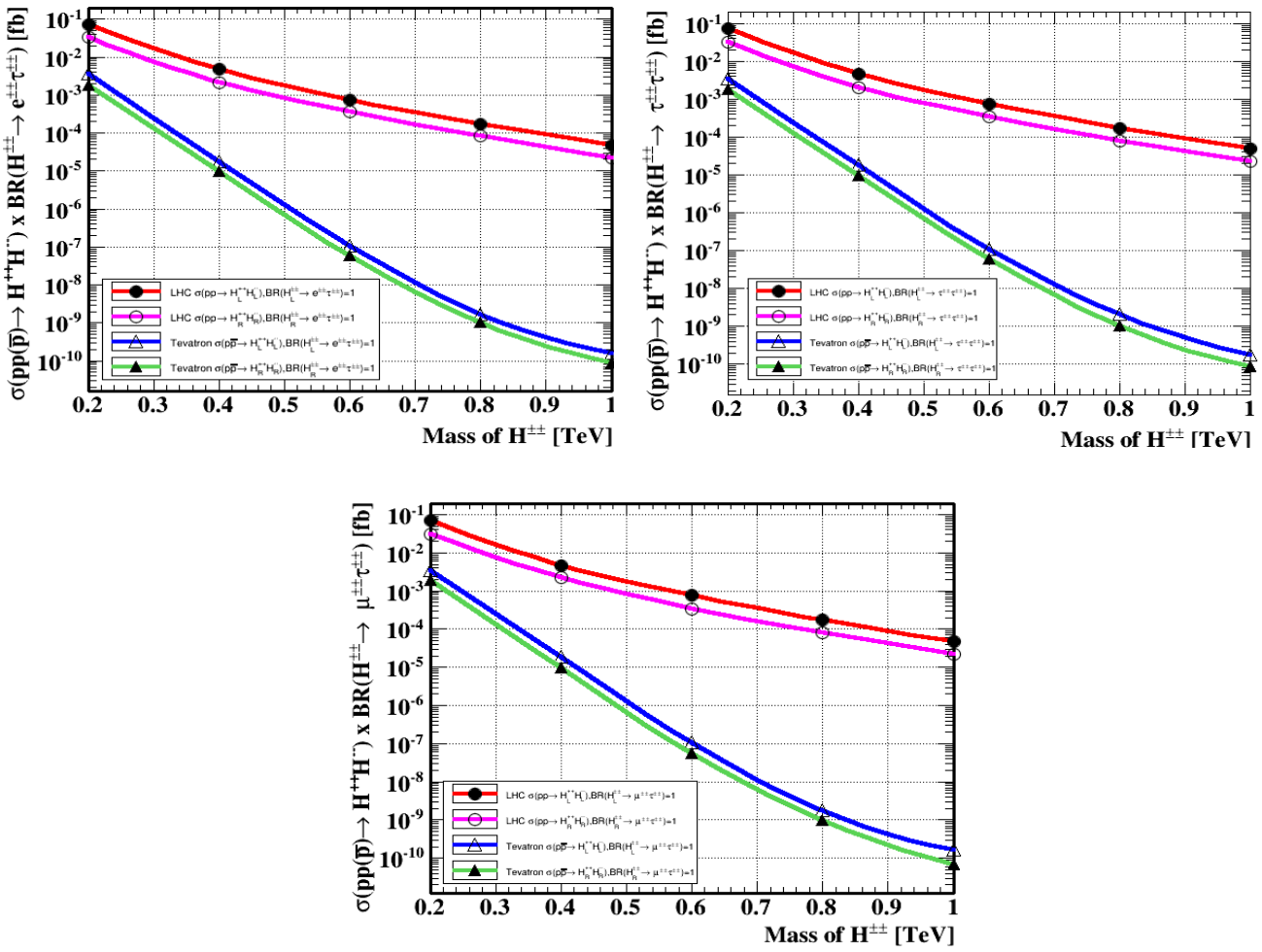


Figure 2 : The production cross section times branching ratio for pair production of $H_L^{\pm\pm}$ or $H_R^{\pm\pm}$ bosons at the LHC and the Tevatron decays to (a) $e^{\pm}\tau^{\pm}$ (b) $\mu^{\pm}e^{\pm}$ (c) $\tau^{\pm}\tau^{\pm}$ at $\sqrt{s}$ = 14 TeV (in the Left-Right Symmetric Model using Pythia8 and MadGraph5).

b) Decay Width of $H^{\pm\pm}$

Doubly-charged Higgs bosons can couple to either left-handed or right-handed fermions. In Left-Right Symmetric Model, the two cases are distinguished and denoted $H_L^{\pm\pm}$ and $H_R^{\pm\pm}$. The $H^{\pm\pm}$ boson may decay to a pair of like-sign leptons whose invariant mass is consistent with the mass of M($H^{\pm\pm}$). The partial decay width to leptons is given by:

$$\Gamma(H^{\pm\pm} \to \ell^{\pm}\ell^{\pm}) = k\frac{h_{\ell\ell'}^2}{16\pi}m(H^{\pm\pm})$$

Where k = 2 if both leptons have the same flavour ($\ell = \ell'$) and k = 1 if they have a different flavor. The factor $h_{\ell\ell'}$ is the coupling parameter.

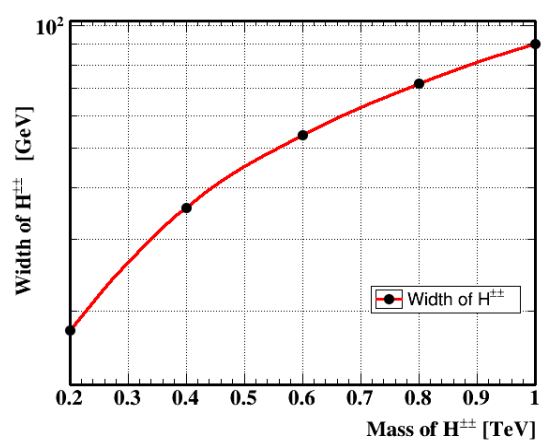


Figure 3 : Decay Width of $H^{\pm\pm}$ bosons as a function of $H^{\pm\pm}$ mass values (in the Left-Right Symmetric Model using Pythia8 and MadGraph5).

The electron identification uses a cut-based approach in order to reject jets misidentified as electrons, or electrons originating from photon

© 2014 Global Journals Inc. (US)

conversions. In addition, electrons are required to have pT > 20 GeV and$|\eta| < 2.5$. For Muon candidates are required to have pT > 5 GeV and$|\eta| < 2.4$. Isolation of the final state leptons plays a key role in suppressing the SM backgrounds.

c) Branching Ratios of $H^{\pm\pm}$

The mass limits obtained for the $H^{\pm\pm}$ bosons depend on the ranching ratio (BR) assumed. The most stringent limits were set by the CMS Collaboration [9], masses below 382 GeV, 391 GeV, and 395 GeV for, $e^{\pm}e^{\pm}, \mu^{\pm}\mu^{\pm}$ *and* $e^{\pm}\mu^{\pm}$ final states, respectively, assuming left-handed couplings and a 100% branching ratio to each final state. In current work a search for a $H^{\pm\pm}$ boson decaying to pairs of electrons or muons or taus with the same electric charge $H^{\pm\pm} \rightarrow e^{\pm}e^{\pm}$, $H^{\pm\pm} \rightarrow \mu^{\pm}\mu^{\pm}$ and $H^{\pm\pm} \rightarrow \tau^{\pm}\tau^{\pm}$ is 12% but for electrons and muons and taus is 22% . Also the branching fraction of doubly-charged Higgs boson decay to W boson is small as shown in Figure (4)

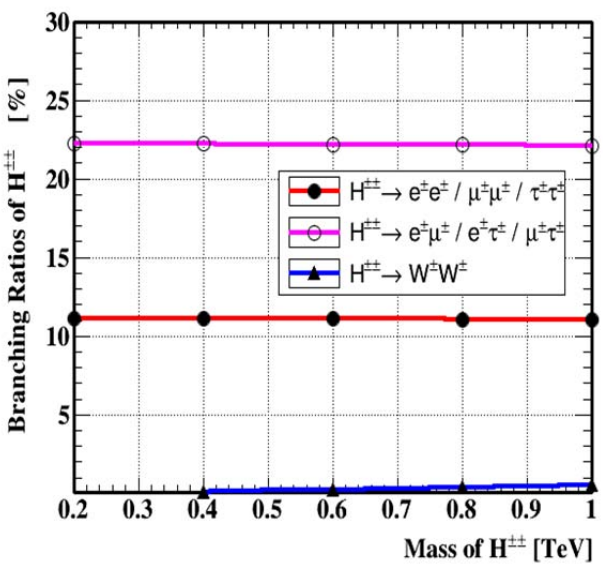


Figure 4 : Branching Ratios of $H^{\pm\pm}$ bosons as a function of $H^{\pm\pm}$ mass values (in the Left-Right Symmetric Model using Pythia8 and MadGraph5).

d) Dilepton Invariant Mass Distributions

Figure (5) shows the invariant mass distributions for the two leptons in final state produced from $H^{\pm\pm}$ bosons decay for different values of $H^{\pm\pm}$ masses at the LHC $\sqrt{s}$=14 TeV for $e^{\pm}e^{\pm}, \mu^{\pm}\mu^{\pm}$ *and* $e^{\pm}\mu^{\pm}$. The invariant mass of the lepton pair must be larger than 15 GeV, and for $e^{\pm}e^{\pm}$ the region close to the Z-boson mass (70 GeV < m($e^{\pm}e^{\pm}$) < 110 GeV) is excluded due to a large background from $Z \rightarrow e^{\pm}e^{\pm}$ events with an electron charge misidentification, as described below. The first limits on the $H_L^{\pm\pm}$ mass were derived based on the measurements done at PEP and PETRA experiments [11]. Next, the $H^{\pm\pm}$ was searched for at the MARK II detector at SLAC [12], the H1 detector at HERA [13] and the LEP experiments [14].

As we mentioned before the pair production cross section for left-handed doubly charged Higgs bosons for 200 GeV < M($H^{\pm\pm}$) < 800 GeV is larger than that for the right-handed states due to different couplings to the intermediate Z boson [10]. Leptons must have a transverse momentum above 30 GeV, in pairs where the higher transverse momentum lepton is an electron, it is required to have pT > 25 GeV. All pairs of electrons or muons with the same electric charge are considered, so more than one lepton pair may be reconstructed per event.

In our search we look for an excess of events in one or more flavor combinations of same-sign lepton pairs coming from the decays $H^{\pm\pm} \rightarrow \ell^{\pm}\ell'^{\pm}$ so the final states containing four charged leptons are considered. From the dilepton events to test the presence of a $H_L^{\pm\pm}$ boson at LHC and Tevatron through resonance search technique $M(\ell^{\pm}\ell^{\pm})$ analysis. By using PYTHIA8 we note 4 peaks correspond to four different values of $H_L^{\pm\pm}$ mass 200,400,600 and 800 GeV. The most important experimental signature of the $H^{\pm\pm}$ is the presence of two like-charge leptons in the final state, with a resonant structure in their invariant mass spectrum. In this final state the background from SM processes is expected to be very small. For the four-lepton final state from $H^{++}H^{--}$ pair production, both Higgs bosons may be reconstructed, giving two like-charge pairs of leptons with similar invariant mass.

© 2014 Global Journals Inc. (US)

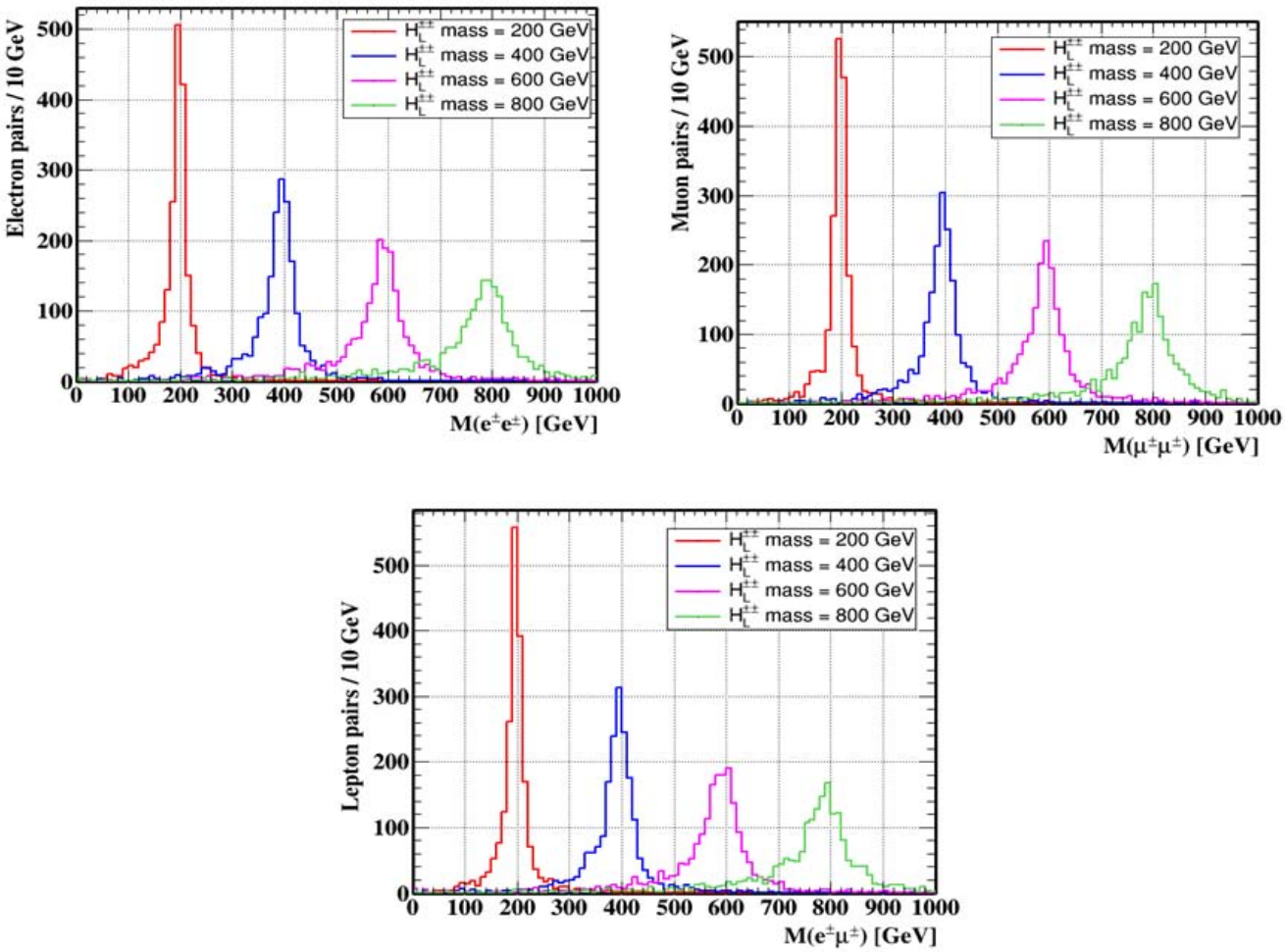


Figure 5 : Invariant mass distributions for two leptons in final state produced from $H_L^{\pm\pm}$ bosons decay for different values of $H_L^{\pm\pm}$ mass at the LHC $\sqrt{S}$=14 TeV (a) $e^{\pm}e^{\pm}$ (b) $\mu^{\pm}\mu$, (c) $e^{\pm}\mu^{\pm}$ (in the Left-Right Symmetric Model using Pythia8 and MadGraph5).

Experiments at the CERN LEP collider have searched for pair production of doubly charged Higgs bosons in $e^{\pm}e^{\pm}$ interactions. Mass limits for decays into muons of $M(H_L^{\pm\pm})$ >100.5 GeV/c2 and $M(H_R^{\pm\pm})$ >100.1 GeV/c2 were obtained by the OPAL collaboration [24], and a limit of M($H_{L(R)}^{\pm\pm}$) > 99.4 GeV/c2 by the L3 collaboration [25]. Similar limits were set for decays into electrons and τ-leptons [26]. Previous searches for $H^{\pm\pm}$ have been performed by the LEP collaborations in $e^{\pm}e^{\pm}$ collisions and by the D0 [27] and CDF [28] collaborations at the Tevatron $p\bar{p}$ collider.

e) Leptons Angular Distributions

Figure (6) shows the angular distribution of four leptons in final state of produced from the decay of pair doubly-charged Higgs boson events which act as forward and backward events for interaction. The angular distribution can also be used to test the presence of $H_L^{\pm\pm}$ boson at the LHC and the Tevatron, we see from the figure that there is a symmetry around value for different values of masses for $H_L^{\pm\pm}$.

© 2014 Global Journals Inc. (US)

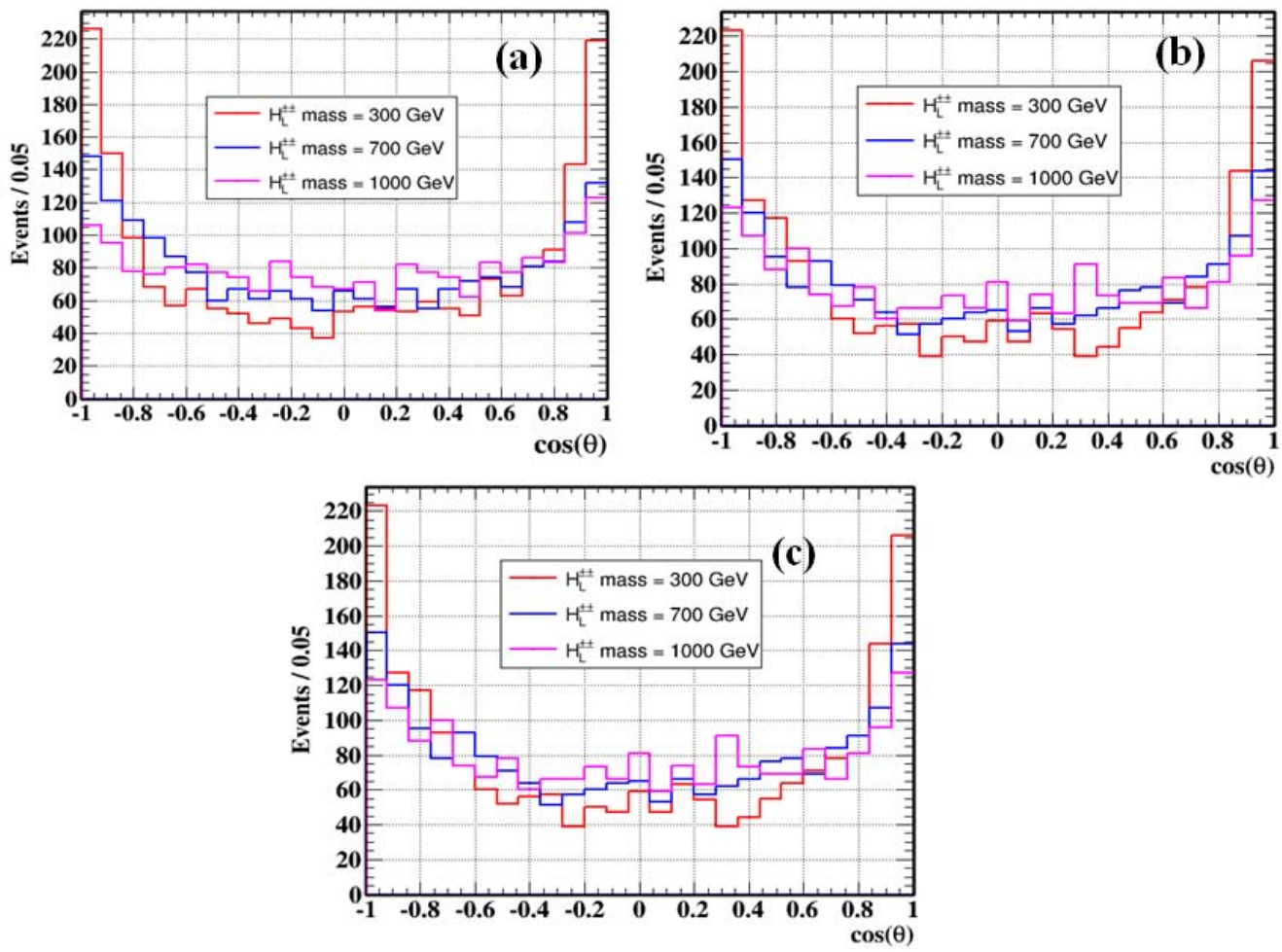
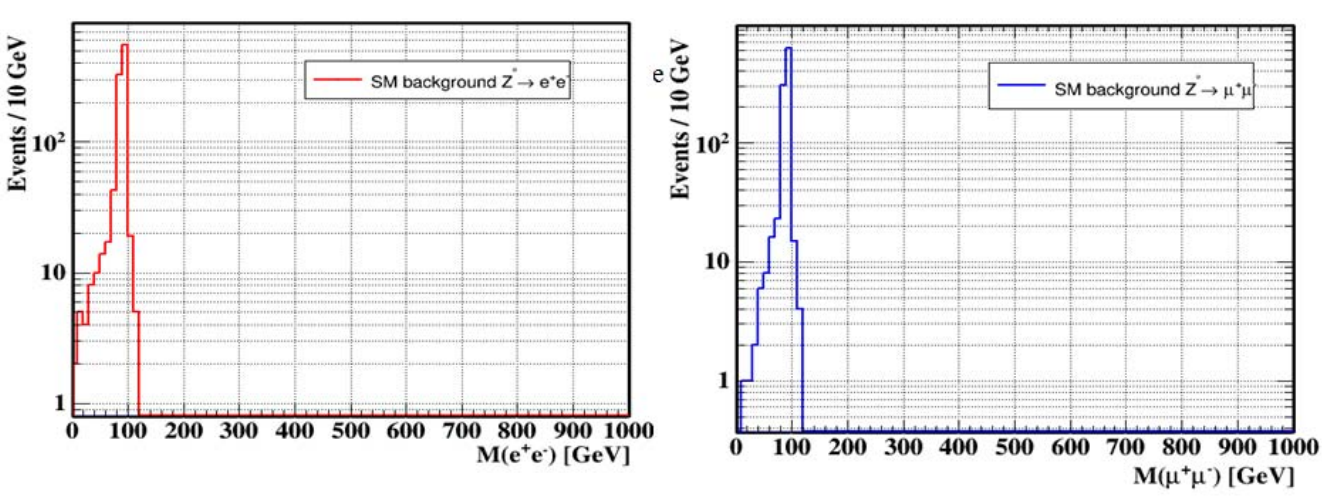


Figure 6 : Angular distribution (forward and backward) of leptons in the final state produced from doubly charged Higgs decay for M($H_L^{\pm\pm}$) =300,700 and 1000 GeV at the LHC $\sqrt{s}$=14 TeV (a) $e^{\pm}e^{\pm}$ (b) $\mu^{\pm}\mu^{\pm}$ (c) $e^{\pm}\mu^{\pm}$ (in the Left-Right Symmetric Model using Pythia8 and MadGraph5).

f) Standard Model Background

The dominant SM background comes from Zo decay. Figure (7) shows the generated $e^{\pm}e^{\pm}$, $\mu^{\pm}\mu^{\pm}$ *and* $e^{\pm}\mu^{\pm}$ events for a reconstructed mass of 300 GeV for SM Zo. We note that there is a peak centered around 100 GeV. According to the SM this peak corresponds to the production of a Zo with a mass of 91.188 GeV. This process



© 2014 Global Journals Inc. (US)

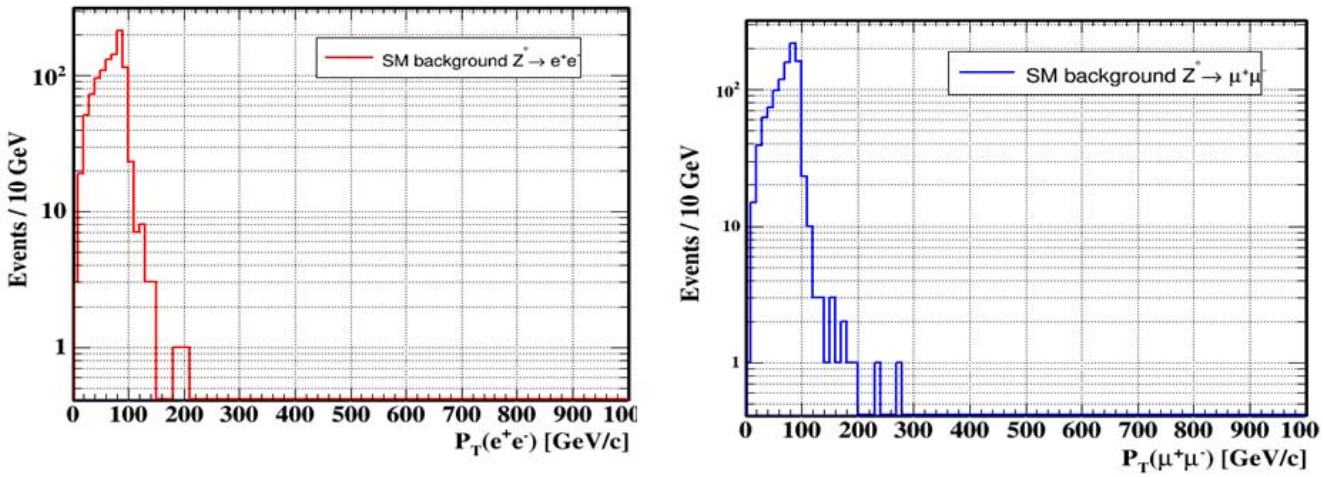


Figure 7 : The Drell-Yan process background – the invariant mass of electrons and muons (Top) produced from Z° boson and the transverse momentum for electrons and muons (Bottom) (in the Left-Right Symmetric Model using Pythia8 and MadGraph5).

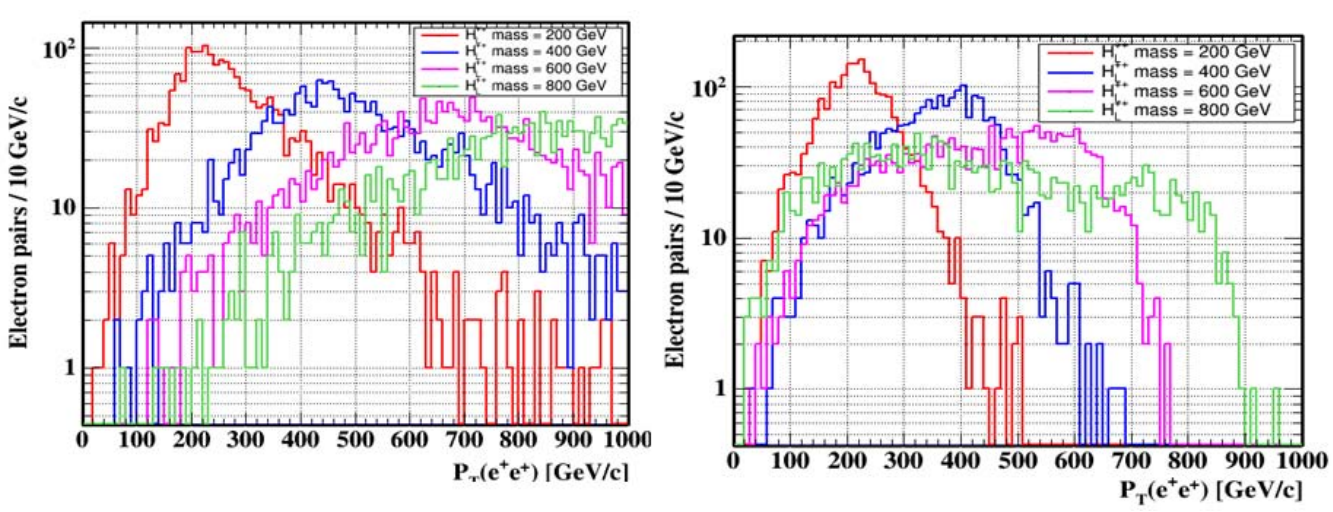
SM backgrounds in this search come from like-sign lepton pairs is WZ production, and smaller sources include ZZ, like-sign WW, $t\bar{t}W$, and $t\bar{t}Z$production. The $H^{\pm\pm}$ process is simulated using PYTHIA8 [16] to estimate the acceptance and efficiency for reconstructing $H^{\pm\pm}$ bosons with masses between 200 GeV and 800 GeV. The latest results are from the Tevatron and ATLAS [17–19] experiments, which set lower limits on the $H^{\pm\pm}$ mass between 112 and 355 GeV, depending on assumptions regarding $H^{\pm\pm}$ branching fractions. In all previous searches, only the pair-production mechanism, and only a small fraction of the possible final state combinations, were considered. The addition of associated production and all possible final states significantly improves the sensitivity and reach of this analysis.

The kinematic properties of $H_L^{\pm\pm}$ and $H_R^{\pm\pm}$ bosons are identical only their cross sections differ. In this article the results of a search for a doubly-charged Higgs boson at the LHC and the Tevatron using Monte Carlo simulation Techniques experiments are presented the pair-production process $pp(\bar{p}) \rightarrow H^{++}H^{--} \rightarrow \ell_\alpha^+\ell_\beta^+\ell_\lambda^-\ell_\delta^-$ [20, 21] and the associated production process $pp(\bar{p}) \rightarrow H^{++}H^{--} \rightarrow \ell_\alpha^+\ell_\beta^+\ell_\lambda^-\nu_\delta$ [22, 23] are studied.

g) Transverse Momentum Distributions

The transverse-momentum PT distributions and rapidity of the $H_L^{\pm\pm}$ boson provide new information about the dynamics of proton collisions at high energies and the PT spectrum provides a better understanding of the underlying collision process at low transverse momentum.

Figure (8) shows the transverse momentum PT distributions of different combination of electron and muon in final state in invariant mass region 200 < $M_{e^+e^-}$< 800 GeV produced from $H_L^{\pm\pm}$ decay. The results are obtained using PYTHIA8 of proton-proton collisions at a center-of-mass energy of 14 TeV at LHC. The distributions are measured over the ranges $|\eta| < 2.5$.



© 2014 Global Journals Inc. (US)

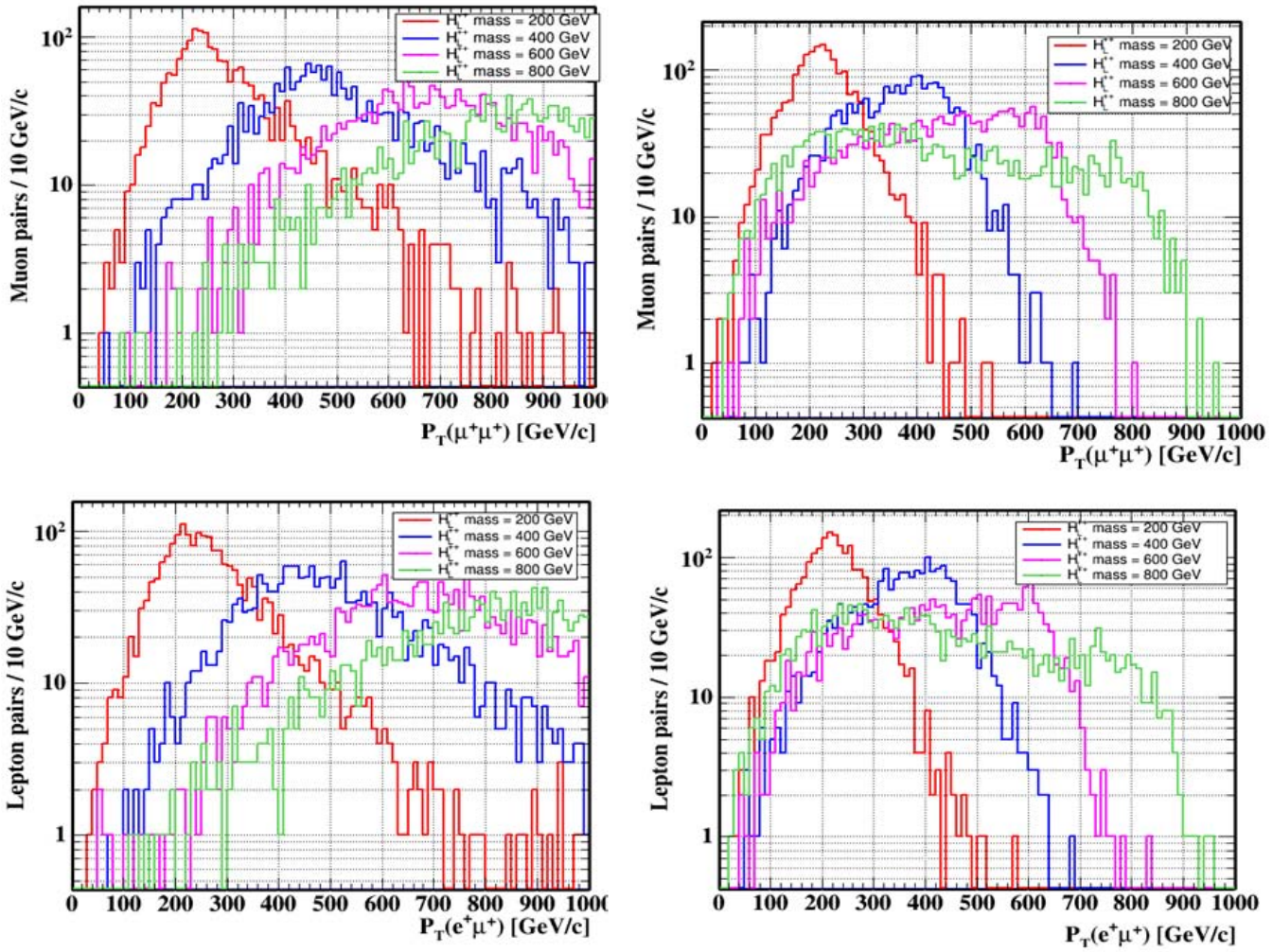


Figure 8 : Transverse momentum distributions of $e^{\pm}e^{\pm}$, $\mu^{\pm}\mu^{\pm}$ *and* $e^{\pm}\mu^{\pm}$ for different values of $H_L^{\pm\pm}$ mass at the LHC $\sqrt{s}$=14 TeV (Left column) and at the Tevatron $\sqrt{s}$=1.96 TeV (Right column)

For the $e^{\pm}e^{\pm}$, $\mu^{\pm}\mu^{\pm}$ *and* $e^{\pm}\mu^{\pm}$ channels in Figure (5) assuming a branching ratio to the given lepton flavour of 100% assuming that the sum of the branching fractions of the $H^{\pm\pm}$ to all lepton flavour combinations is 100%. The dominant background in this analysis arises from electroweak processes where real high pT muons are created from W or Z boson decays as well as non-isolated muons originating from jets. The SM backgrounds and signal processes are generated with Pythia8 [29].

The signal final state consists of four charged leptons. Two like-sign leptons originate from the $H^{\pm\pm}$ decay and are expected to be visible in the detector in most cases. A search for a doubly-charged Higgs boson in proton-proton and proton-antiproton collisions are presented. The search is performed using events with three or more isolated charged leptons of any flavor. The $H^{\pm\pm}$ particle carries double electric charge, and decays to same-sign lepton pairs $\ell^{\pm}\ell'^{\pm}$. The relevant Production cross sections, calculated following are presented in Figures 1 and 2. $H^{\pm\pm}$ is assumed to decay in 100% of the cases in turn in each of the possible lepton combinations $ee, \mu\mu, \tau\tau, e\mu, e\tau, \mu\tau$

h) Transverse Energy Distributions

Figure (9) show the transverse energy of different combination of leptons produced from the decay of for different values of $H_L^{\pm\pm}$ masses at the LHC $\sqrt{s}$ =14 TeV (Left column) and at the Tevatron $\sqrt{s}$ =1.96 TeV (Right column). We see that there are four peaks for every mass value of $H_L^{\pm\pm}$. Transverse energy is defined as $E_T = E\sin(\theta)$

© 2014 Global Journals Inc. (US)

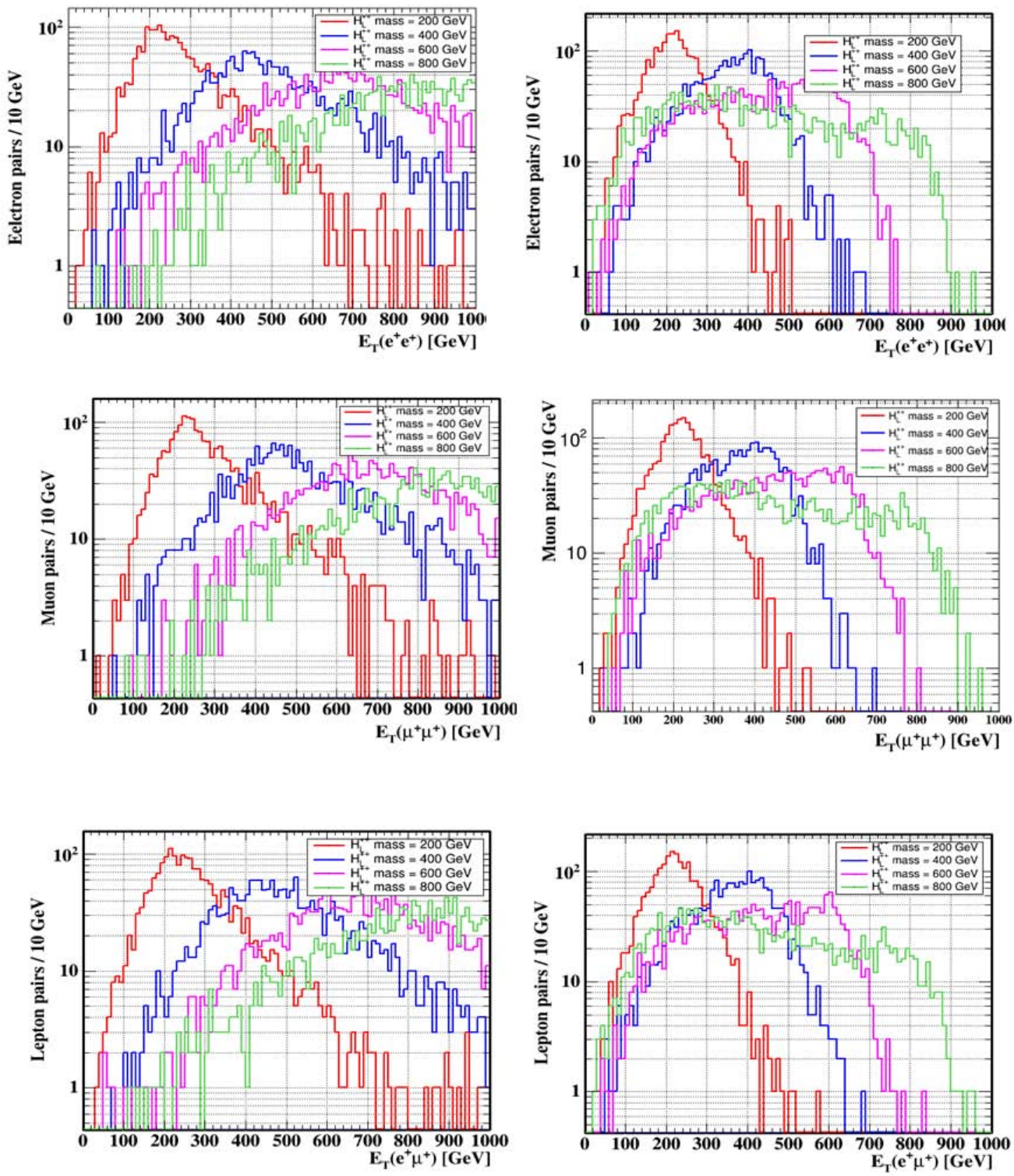


Figure 9 : Transverse Energy distributions of $e^{\pm}e^{\pm}$, $\mu^{\pm}\mu^{\pm}$ *and* $e^{\pm}\mu^{\pm}$ for different values of $H_L^{\pm\pm}$ mass at the LHC $\sqrt{s}$ =14 TeV (Left column) and at the Tevatron $\sqrt{s}$ =1.96 TeV (Right column).

i) Pseudorapidity Distributions

The selected electrons must be in the central or in the forward regions of $|\eta| < 2.5$ then we choose the two highest-energy electron or muons where η is the pseudo rapidity of emitted electrons which describes the angle of a particle relative to beam axis.

$$\eta = -\ln\left[\frac{\theta}{2}\right]$$

θ is the angle between the particle momentum vector P and the beam axis see figure.

© 2014 Global Journals Inc. (US)

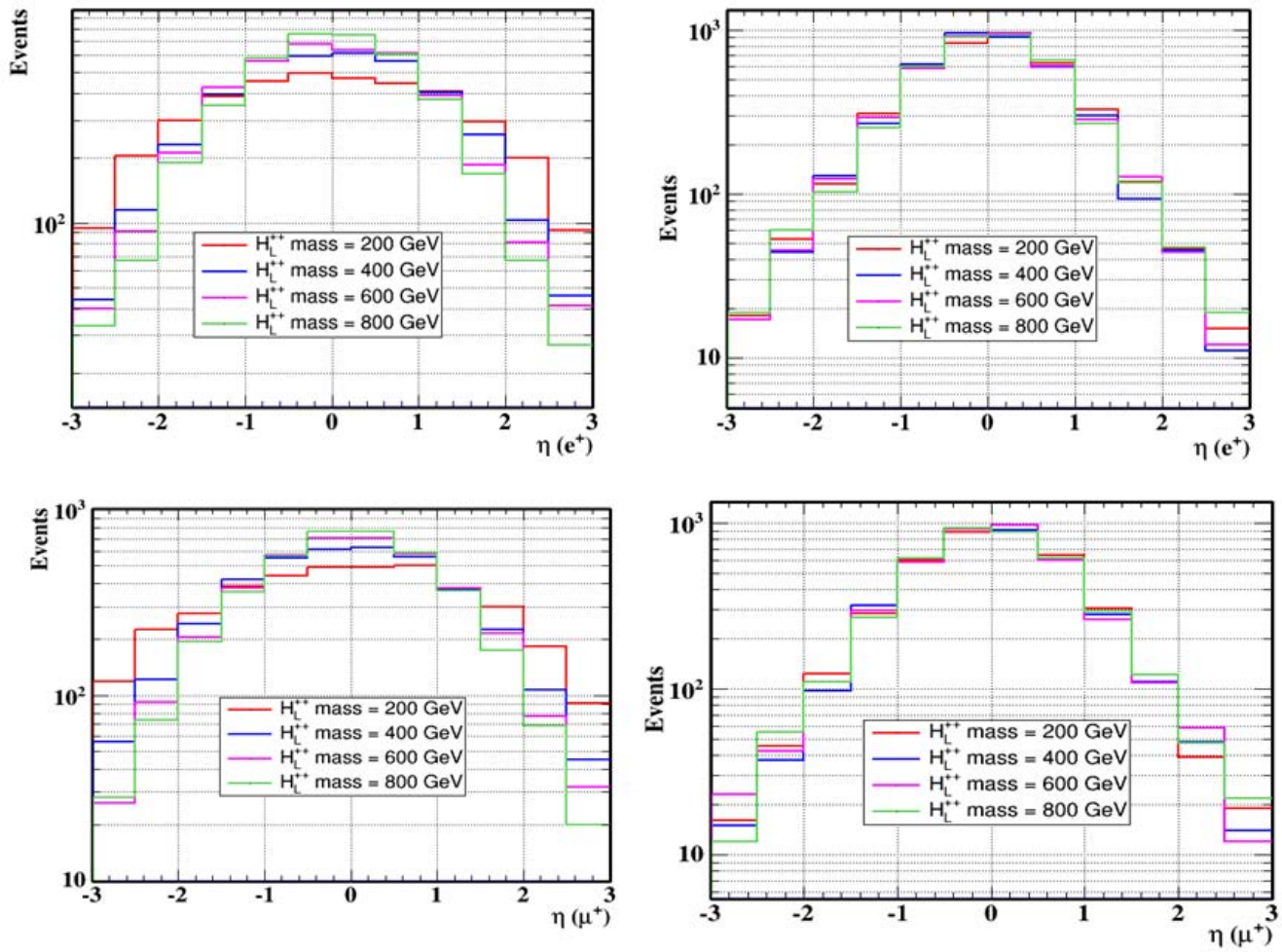


Figure 10 : Pseudorapidity distributions of Electrons and Muons for different values of $H_L^{\pm\pm}$ mass at the LHC $\sqrt{s}$= =14 TeV (Left column) and at the Tevatron $\sqrt{s}$=1.96 TeV (Right column)

j) Rapidity Distribution

The Rapidity y is a measure of where a lepton is located in space and is defined as:

$$y = \frac{1}{2}\ln\frac{(E + P_T)}{(E - P_T)}$$

where E is the energy of the H^{++} candidate and PT is its longitudinal momentum along the anticlockwise beam axis (the z axis of the detector). The y and PT of H^{++} are determined from the leptons momenta.. The distributions are corrected for signal acceptance and efficiency and for the effects of detector resolution and electromagnetic final-state radiation (FSR) using an unfolding technique based on the inversion of a response matrix. The final result takes into account the bin width and is normalized by the measured total cross section.

© 2014 Global Journals Inc. (US)

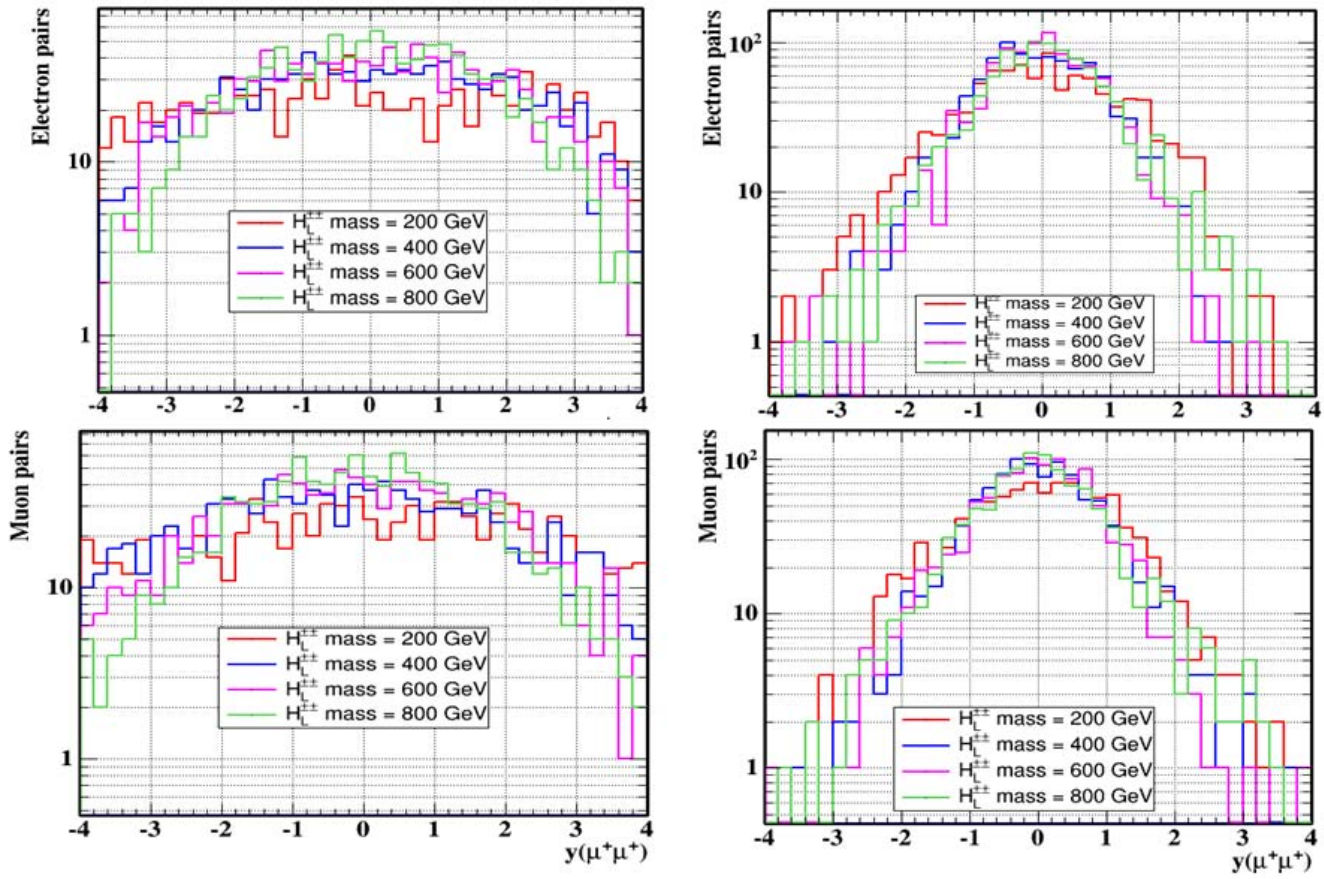


Figure 11 : Rapidity distributions of Electrons and Muons for different values of $H_L^{\pm\pm}$ mass at the LHC $\sqrt{s}$ =14 TeV (Left column) and at the Tevatron $\sqrt{s}$ =1.96 TeV (Right column)

III. Conclusion

In this work we have analyzed doubly-charged Higgs pair production at the Tevatron and the LHC using Monte Carlo event generators Pythia8 and also by MadGraph5. The doubly-charged Higgs boson can be decayed to $e^{\pm}e^{\pm}, \mu^{\pm}\mu^{\pm}$ or $e^{\pm}\mu^{\pm}$ so we can search for four charged leptons in final state produced from doubly-charged Higgs boson pair via the process$pp(\bar{p}) \rightarrow H^{\pm\pm}H^{\pm\pm} \rightarrow \ell^{\pm}\ell^{\pm}\ell^{\pm}\ell^{\pm},\ \ell = e^{\pm}, \mu^{\pm}$. We serarched for a narrow resonance peak in the dilepton mass distribution produced from $H^{\pm\pm}$ decay. Also we calculated the production Cross section of doubly charged Higgs boson pair at the LHC and at the Tevatron for left-hand $H_L^{\pm\pm}$ and right-hand $H_R^{\pm\pm}$. We found that the production cross section depends on the mass of the $H^{\pm\pm}$ boson in the final state. We calculated different dynamics distributions for the different combination of leptons in the final states assuming pair production couplings to left handed leptons, and a branching ratio of 100% BR($H^{\pm\pm} \rightarrow \ell^{\pm}\ell^{\pm} = 1, \ell = e^{\pm}, \mu^{\pm}$). for each final state. Finally, the doubly charged Higgs may be found at the LHC or at the Tevatron in the mass range up to 800 GeV.

IV. Acknowledgment

It is a pleasure to thank Prof. Torbjörn Sjostrand - Lund Univ. Sweden for useful discussions of PYTHIA, Prof. Johan Alwall - Stanford Univ. USA for useful discussions of MadGraph5/MadEvent. The work by Maxim Yu. Khlopov was supported by the Ministry of Education and Science of Russian Federation, project 3.472.2014/K and in the part related with various forms of dark matterby the grant RFBR 14-22-03048.

References Références Referencias

1. J.C. Pati and A. Salam, Phys. Rev. D 10, 275 (1974); R.N. Mohapatra and J.C. Pati, Phys.Rev. D 11, 566 (1975); G. Senjanovic and R.N. Mohapatra, Phys. Rev. D 12, 1502 (1975). T.Rizzo, Phys. Rev. D 25, 1355 (1982) and Addendum ibid 27, 657 (1983);
2. H. Georgi and M. Machacek, Nucl. Phys. B 262, 463 (1985); J.F. Gunion,R. Vega, and J. Wudka, Phys. Rev. D 42, 1673 (1990); J.F. Gunion, C. Loomis, and K.T.Pitts, hep-ph/9610237 (1996).
3. N. Arkani-Hamed et al., JHEP 0208, 021, (2002).
4. T. Sj ¨ostrand et al., "PYTHIA 6.4 physics and manual", JHEP 05 (2006) 026, doi:10.1088/1126-6708/2006/05/026, arXiv:hep-ph/0603175.

© 2014 Global Journals Inc. (US)

5. J. Alwall et al., "MadGraph/MadEvent v4: the new web generation", JHEP 09 (2007) 028, doi:10.1088/1126-6708/2007/09/028, arXiv:0706. 2334.
6. M. Magg and C. Wetterich, "Neutrino mass problem and gauge hierarchy", Phys. Lett. B 94 (1980) 61, doi:10.1016/0370-2693(80)90825-4.
7. K.S. Babu, Phys. Lett. B 203, 132 (1988).
8. T. Sj¨ostrand, Comp. Phys. Comm. 39 (1986) 347; T. Sj¨ostrand, PYTHIA 5.7 and JETSET 7.4 Manual, CERN-TH 7112/93; T. Sj¨ostrand et al., Computer Phys. Commun. 135 (2001) 238.
9. CMS Collaboration (2012). arXiv:1207.2666 (submitted to Eur. Phys. J. C).
10. M. M¨uhlleitner and M. Spira, Phys. Rev. D 68, 117701 (2003).
11. M. L. Swartz, "Limits on doubly charged Higgs boson and lepton flavor violation", Phys.Rev. D 40 (1989) 1521, doi:10.1103/PhysRevD.40.1521.
12. M. L. Swartz et al., "A search for doubly charged Higgs scalars in Z decay", Phys. Rev.Lett. 64(1990) 2877, doi:10.1103/PhysRevLett.64.2877.
13. H1 Collaboration, "Search for doubly-charged Higgs boson production at HERA", Phys.Lett. B 638 (2006) 432, doi:10.1016/j.physletb.2006.05.061.
14. OPAL Collaboration, "Search for doubly charged Higgs bosons with the OPAL detector at LEP", Phys. Lett. B 526 (2002) 221, doi:10.1016/S0370-2693(01)01474-5,arXiv:hep-ex/0111059.
15. D.Bandurin Kansas State University, CMS AN-2008/044.
16. T. Sjöstrand, S. Mrenna, P. Skands, JHEP 05, 026(2006).
17. CDF Collaboration, "Search for new physics in high pT like-sign dilepton events at CDF II", Phys. Rev. Lett. 107 (2011) 1801,doi:10.1103/PhysRevLett. 107.181801.
18. ATLAS Collaboration, "Search for anomalous production of prompt like-sign muon pairs and constraints on physics beyond the Standard Model with the ATLAS detector", Phys. Rev. D 88 (2012) 032004, doi:10.1103/PhysRevD.85.032004.
19. D0 Collaboration, "Search for Doubly Charged Higgs Boson Pair Production in pp Collisions at ps = 1.96 TeV", Phys. Rev. Lett. 108 (2012) 021801, doi:10.1103/PhysRevLett.108.021801, arXiv:1106. 4250.
20. K. Huitu et al., "Doubly charged Higgs at LHC", Nucl. Phys. B 487 (1997) 27, doi:10.1016/S0550-3213(97)87466-4, arXiv:hep-ph/9606311.
21. M. Muhlleitner and M. Spira, "A note on doubly-charged Higgs pair production at hadron colliders", Phys. Rev. D 68 (2003) 117701, doi:10.1103/Phys RevD.68.117701, arXiv:hep-ph/0305288.
22. A. G. Akeroyd and M. Aoki, "Single and pair production of doubly charged Higgs bosons at hadron colliders", Phys. Rev. D 72 (2005) 035011, doi:10.1103/PhysRevD.72.035011, arXiv:hep ph/ 0506176.
23. A. G. Akeroyd, C.-W. Chiang, and N. Gaur, "Leptonic signatures of doubly charged Higgs boson production at the LHC", JHEP 11 (2010) 005, doi:10.1007/JHEP11(2010)005, arXiv:1009.2780.
24. G. Abbiendi et al. (OPAL Collaboration), Phys. Lett. B 577, 93 (2003); G. Abbiendi et al. (OPAL Collaboration), Phys. Lett. B 526, 221 (2002). P.D. Acton et al. (OPAL Collaboration),Phys. Lett. B 295, 347 (1992).
25. P. Achard et al. (L3 Collaboration), Phys. Lett. B 576, 18 (2003).
26. J. Abdallah et al. (DELPHI Collaboration), Phys. Lett. B 552, 127 (2003).
27. D0 Collaboration, V.M. Abazov et al., Phys. Rev. Lett. 93, 141801 (2004).
28. CDF Collaboration, D. Acosta et al., Phys. Rev. Lett. 93, 221802 (2004).
29. T. Sj¨ostrand et al., Comput. Phys. Commun. 135, 238 (2001).

© 2014 Global Journals Inc. (US)

Global Journal of Science Frontier Research: A
Physics and Space Science
Volume 14 Issue 5 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Supersymmetry Quantum Mechanics and Exact Solutions of the Effective Mass of Schrodinger Equations with Rosen-Morse Potential

By R.Amiri & M.Tavakkoli
Islamic Azad University, Iran

Abstract- In quantum mechanics a localized attractive potential typically supports a (possibly infinite) set of bound states, characterized by a discrete spectrum of allowed energies, together with a continuum of scattering states, characterized (in one dimension) by energy-dependent phase shift. The Morse potential named after physicist Philip M.Morse, is a convenient model for the potential energy of a diatomic molecule. It is a better approximation for the vibrational structure of the molecule than the quantum harmonic oscillator because it explicitly includes the effects of bond breaking such as the existence of unbound states. It also accounts for the anharmonicity of real bonds and the non-zero transition probability for overtone and combination bands. The Morse potential can also be used to model other interactions such as the interaction between an atom and a surface. We here make the case that the trigonometric Rosen-Morse potential is exactly soluble in terms of a family of real orthogonal polynomials and present the solutions. and analytical solutions of the Klein-Gordon equation for the Rosen-Morse potential with equal scalar and vector potentials are studied in this paper.

Keywords: supersymmetry, morse-rosen potential, eckart potential, schrodinger eqation.

GJSFR-A Classification : FOR Code: 020699

SUPERSYMMETRY QUANTUM MECHANICS AND EXACT SOLUTIONS OF THE EFFECTIVE MASS OF SCHRODINGER EQUATIONS WITH ROSEN-MORSE POTENTIAL

Strictly as per the compliance and regulations of :

© 2014. R.Amiri & M.Tavakkoli. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Supersymmetry Quantum Mechanics and Exact Solutions of the Effective Mass of Schrodinger Equations with Rosen-Morse Potential

R.Amiri [α] & M.Tavakkoli [σ]

Abstract- In quantum mechanics a localized attractive potential typically supports a (possibly infinite) set of bound states, characterized by a discrete spectrum of allowed energies, together with a continuum of scattering states, characterized (in one dimension) by energy-dependent phase shift. The Morse potential named after physicist Philip M.Morse, is a convenient model for the potential energy of a diatomic molecule. It is a better approximation for the vibrational structure of the molecule than the quantum harmonic oscillator because it explicitly includes the effects of bond breaking such as the existence of unbound states. It also accounts for the anharmonicity of real bonds and the non-zero transition probability for overtone and combination bands. The Morse potential can also be used to model other interactions such as the interaction between an atom and a surface. We here make the case that the trigonometric Rosen-Morse potential is exactly soluble in terms of a family of real orthogonal polynomials and present the solutions. and analytical solutions of the Klein-Gordon equation for the Rosen-Morse potential with equal scalar and vector potentials are studied in this paper.

Keywords: supersymmetry, morse-rosen potential, eckart potential, schrodinger eqation.
PACs: 11.30.Pb

I. Introduction

The supersymmetric quantum mechanics manages a family of exactly soluble potentials, one of them being the trigonometric Rosen-Morse potential. As long as this potential is obtained from the Eckart potential by complexification of the argument and one of the constants,also its solutions have been concluded rfom those of the Eckart potential by same procedure.

Supersymmetric quantum mechanics was originally proposed by Witten as a simple learning ground for the basic concepts of supersymmetric quantum field theories but soon after it evolved to a research field on its own rights. Supersymmetric quantum mechanics starts with the factorization of one-dimensional Hamiltonians,

$$H(y) = -\frac{\hbar^2}{2m}\frac{d^2}{dy^2} + V(y) \qquad (1)$$

According to $H(y) = A^{+}(y)A^{-}(y) + \mathcal{E}$ with $A^{\pm}(y) = (\pm\frac{\hbar}{\sqrt{2m}}\frac{d}{dy} + U(y))$ Where $U(y)$ is the superpotential [1-3]. supersymmetry is arguably the most attractive mechanism to stabilize the hierarchy between the fundamental scale (e.g. the Planck scale $M_* \sim 10^{18}$ *GeV)* and the electroweak scale ($M_w \sim 100GeV$). However, superpartners of the standard model particles have not been observed up to energies of order *Mw*, so supersymmetry must be broken at or above the weak scale.The phenomenology of supersymmetry depends crucially on the mechanism of supersymmetry breaking and the way that supersymmetry breaking is communicated to the observable sector. The supersymmetric quantum mechanics manages a family of exactly soluble potentials, one of them being the trigonometric Rosen-Morse potential .we make the point that the trigonometric Rosen-Morse potential is of possible interest to quark physics in so far as it captures the essentials of the QCD quark-gluon dynamics [4-6].

II. The Morse Potential Energy Function

Exact solutions of the effective mass of schrodonger equations for the mentioned potentials are interesting in the fields of material science and condense matter physics. There are various methods for exact solutions to energy eigenvalues and corresponding wave function [7,8].

We can quite write the schrodinger equation in three dimensions for a diatomic molecule with the mass of nuclei m_1 and m_2 as the following form:

$$\left(-\frac{\hbar^2}{2\mu}\nabla^2 + V(r)\right)\psi_{nlm}(r,\theta,\varphi) = E\psi_{nlm}(r,\theta,\varphi) \qquad (2)$$

Where $\hbar$, μ , $V(r)$ and E are Planck's constant, reduced mass, spherical potential and eigenvalue energy of a quantum system. The radial part of the wave function $R_{nl}(r)$ is defined by relation of $\psi_{nlm}(r,\theta,\varphi) = \frac{R_{nl}(r)}{r} Y_{lm}(\theta,\varphi)$ In that case, the radial schrodinger equation is written by,

$$\frac{d^2R_{nl}(r)}{dr^2} + 2(E - V_{eff})R_{nl}(r) = 0 \qquad (3)$$

Where we simply suppose that $\hbar = \mu = 1$ and V_{eff} equal the Rosen-Morse potential plus centrifugal term [8,9].

Author α σ : Department of Physics, Islamic Azad University, Gonabad Branch, Gonabad, Iran. e-mail: marjan.tavakkoli.t@gmail.com

© 2014 Global Journals Inc. (US)

Exactly solvable 1-dimensional Schrodinger equations play an important role in quantum physics. The best known are the harmonic oscillator and the radial equation for the hydrogen atom, which are covered in every course of quantum mechanics.
The Morse potential energy function is o the form

$$V_{eff}(r) = D_e\left(1 - e^{-a(r-r_e)}\right)^2 \tag{4}$$

Here r is the distance between the atoms, r_e is the equilibrium bond distance, D_e is the well depth (defined relative to the dissociated atoms), and a controls the width of the potential) the smaller a is, the larger the well). The dissociation energy of the bond can be calculated by subtracting the zero point energy $E(0)$ from the depth of the well. The force constant of the bond can be found by Taylor expansion of $V(r)$ around $r = r_e$ to the second derivative of the potential energy function, from which it can be shown that the parameter, a, is

$$a = \sqrt{\frac{K_e}{2D_e}} \tag{5}$$

Where K_e is the force constant at the minimum of the well. Since the zero of potential energy is arbitrary, the equation for the Morse potential can be rewritten any number of ways by adding or subtracting a constant value. When it is used to mode the atom- surface interaction, the Morse potential is usually written in the form:

$$V_{eff}(r) - D_e = D_e\left(e^{-2a(r-r_e)} - 2e^{-a(r-r_e)}\right) \tag{6}$$

Where r is now the coordinate perpendicular to the surface. This form approaches zero at infinite r and $-D_e$ at its minimum. It clearly shows that the Morse potential is the combination of a short-range repulsion and a longer-range attractive tail.
The schrodinger equation

$$\left(-\partial_r^2 + V_{eff}(r) - \delta\right)\varphi(r) = 0 \tag{7}$$

Where

$$V_{eff}(r) = \frac{cosr}{sinr} + \left(\frac{\mu^2}{4} - \frac{1}{4}\right)\frac{1}{sin^2 r} \tag{8}$$

This potential is known as the Rosen-Morse potential, also the trigonometric Rosen-Morse potential. to write the stationary states on the Rosen-Morse potential, i.e. solution $\psi(v)$ and $E(v)$ of the following schrodinger equation:

$$\left(-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial r^2} + V_{eff}(r)\right)\psi(v) = E(v)\psi(v) \tag{9}$$

It is convenient to introduce the new variables:

$$x = ar,\quad x_e = ar_e,\quad \lambda = \frac{\sqrt{2mD_e}}{a\hbar},\qquad \mathcal{E}_v = \frac{2m}{a^2\hbar^2}E(v) \tag{10}$$

Then, the schrodinger equation takes the simple form:

$$\left(-\frac{\partial^2}{\partial x^2} + V_{eff}(x)\right)\psi_n(x) = \varepsilon_n\psi_n(x) \tag{11}$$

$$V_{eff}(x) = \lambda^2\left(e^{-2(x-x_e)} - 2e^{-(x-x_e)}\right) \tag{12}$$

Its eigenvalues and eigenstates can be written as:

$$\varepsilon_n = -(\lambda - n - \tfrac{1}{2})^2 \tag{13}$$

$$\psi_n(z) = N_n z^{\lambda-n-\frac{1}{2}} e^{-\frac{1}{2}z} L_n^{2\lambda-2n-1}(z) \tag{14}$$

Where $z = 2\lambda e^{-(x-x_e)}$. whereas the energy spacing between vibrational levels in the quantum harmonic oscillator is constant at $h\nu_O$, the energy between adjacent levels decreases with increasing v in the Rosen-Morse oscillator.

$$\frac{E_v}{hc} = \omega_e\left(v + \frac{1}{2}\right) - \omega_e\chi_e(v + \tfrac{1}{2})^2 \tag{15}$$

In which the constants ω_e and $\omega_e x_e$ can be directly related to the parameters for the Rosen-Morse potential. As is clear from dimensional analysis, for historical reasons the last equation uses spectroscopic notation in which we represents a wave number obeying $E = hc\omega$, and not an angular frequency given by $E = \hbar\omega$ [10-12].

figure 1: the Morse potential (dark) and harmonic oscillator potential (light) unlike the energy levels of the harmonic oscillator potential, which are evenly sapced by $\hbar\omega$, the Morse potential level spacing decreases as the energy approaches the dissociation energy. The dissociation energy D_e is larger than the true energy required for dissociation D_0 due to the zero point energy of the lowest (v=0) vibrational level.[12]

One of the main problems which are involved in many physical processes is the difference of energy state between ground state and first excited state for potential wells. Ground state wave energy E^1 and first excited state energy E^2, as a result:

$$E^1 = \frac{\int_{-\infty}^{+\infty}\varphi(x)(\delta H)\varphi(x)dx}{\int_{-\infty}^{+\infty}\varphi^2(x)dx} = \frac{\int_{-\infty}^{+\infty}\varphi(x)\left[\frac{\left[\psi_0^1(x_0)\right]^2}{I_1}\right]\delta(x-x_0)\varphi(x)dx}{\int_{-\infty}^{+\infty}\varphi^2(x)dx} + \frac{\int_{-\infty}^{+\infty}\varphi(x)\left[\frac{\left[\psi_0^1(-x_0)\right]^2}{I_1}\right]\delta(x+x_0)\varphi(x)dx}{\int_{-\infty}^{+\infty}\varphi^2(x)dx} = \frac{1}{4}\left[\frac{1}{I_1} + \frac{1}{I_2}\right]\frac{1}{\int_{-\infty}^{+\infty}\varphi^2(x)dx} \tag{16}$$

© 2014 Global Journals Inc. (US)

$$E^2 = -\{\int_{-\infty}^{-x_0} dx \left[\frac{E^1 \int_{-\infty}^{x} \varphi^2(x)dx}{\varphi(x)}\right]^2 + \int_{-x_0}^{+x_0} dx \left[\frac{E^1 \int_{-x_0}^{x} \varphi^2(x)dx}{\varphi(x)}\right]^2 + \int_{x_0}^{x} dx \left[\frac{E^1 \int_{x}^{\infty} \varphi^2(x)dx}{\varphi(x)}\right]^2\} \quad (17)$$

$$\Delta E = E^1 + E^2 \quad (18)$$

$$I_+ = \int_{nx_0}^{\infty} \left(\psi_0^1(y)\right)^2 dy, \qquad I_- = \int_{-\infty}^{-nx_0} \left(\psi_0^1(y)\right)^2 dy \quad (19)$$

III. The Shpe of the Trigonometric Rosen-Morse Potential

The study of exactly solvable potentials in quantum mechanics for years has received a lot of attention. For solvable models, the simplest generation technique is supersymmetric quantum mechanics, which is equivalent to the factorizatior method, the intertwining technique and the Darboux transformation method.it is well known that the spectrum of the generated Hamiltonian differs little from the initial one. This suggests a way to realize, in practice, the spectral design: (i) one starts from a potential having a spectrum close to the desired one. (ii) then, by appropriately moving creating or deleting a certain set of levels, and iterating the method as many times as needed to achieve the required spectrum, one will arrive at a Hamiltonian (or a set of Hamiltonians),which could model the situation under study [13].

We adopt the following form of the trigonometric Rosen-Morse potential

$$v(z) = -2bcotz + a(a+1)csc^2 z \quad (20)$$

With $a > -\frac{1}{2}$ and displayed in Fig.1. Here, $z = \frac{y}{d}$, $v(z) = V(zd)/(\frac{\hbar^2}{2md^2})$ and $\mathcal{E}_n = E_n/(\frac{\hbar^2}{2md^2})$, with y being the one-dimensional variable, d a properly chosen length scale, *V(y)* the potential in ordinary coordinate space, and E_n the energy level.

Our point here is that *v(z)* interpolates between the Coulomb - and the infinite wall potential going through an intermediary region of linear-*z*-and harmonic-oscillator-z^2 dependences. To see this it is quite instructive to expand the potential in a Taylor series which for appropriately small *z* takes the form of a coulomb like potential with a centrifugal barrier like term, provided by the $csc^2 z$ part,

$$v(z) \approx -\frac{2b}{z} + \frac{a(a+1)}{z^2}, \quad z << 1 \quad (21)$$

For $z < \frac{\pi}{2}$ we can the take Eq. (20) plus a linear like perturbation

$$\Delta v(z) = \frac{a(a+1)}{3} + \frac{2bz}{3} \quad (22)$$

[14-16]

The $\frac{1}{x^2}$ potential has no ground state, and the allowed energies are not quantized. Perhaps some potential are just plain illegal in quantum mechanics. It seems odd, though, that we never encounter such difficulties in classical mechanics.

Well, in the first place there are classical precursors. Moreover there do exist systems represented by a $\frac{1}{x^2}$ potential [17].

IV. The Rosen-Morse Potentia as Complexified Eckart Potential

Exactly solvable 1-dimensional schrodinger equation play an important role in quantum physics. The best known are the harmonic oscillator and the radial for the hydrogen atom, which are covered in every course of quantum mechanics. A number of other examples were discovered in the 30's of the last century [18].

Before proceeding further we first introduce a properly chosen length scale d and change variables in the one-dimensional equation

$$H(y) = -\frac{\hbar^2}{2m}\frac{d^2}{dy^2} + V(y) \quad (23)$$

To dimensionless ones according to

$$z = \frac{y}{d}, \; v(z) = \frac{V(dz)}{(\hbar^2/_{2md^2})}, \quad \epsilon_n = \frac{E_n}{(\hbar^2/_{2md^2})} \quad (24)$$

Next we employ the Eckart potential,

$$v(z) = -2bcothz + a(a-1)csch^2 z \quad (25)$$

Where $b > a^2$. The exact solutions to the Eckart potential read:

$$\psi_n(x) = c_n(x-1)^{(\beta_n - n - a)/2}(x+1)^{-(\beta_n + n + a)/2} P_n^{\beta_n - n - a, -(\beta_n + n + a)}(x)$$

$$x = \coth z, \qquad \beta_n = \frac{b}{n+a} \quad (26)$$

Here, $P_n^{(\beta_n - n - a, -(\beta_n + n + a))}(x)$ are the well known Jacobi polynomials with $n \leq (b^{1/2} - a)$ and c_n is a constant. Equation {26} equivalently rewrites to

$$\psi_n(x) = c_n(x^2-1)^{-(n+a)/2} e^{-\beta_n \text{ arccoth } x} P_n^{(\beta_n - n - a, -(\beta_n + n + a))}(x) \quad (27)$$

© 2014 Global Journals Inc. (US)

The corresponding energy value spectrum is determined by

$$\epsilon_n = -(n+a)^2 - \frac{b^2}{(n+a)^2} \quad (28)$$

Complexify the argument of the Eckart potential and one of its constants according to

$$z \to -iz\,,\ or\,, equivalently,\ x \to ix\,,\ b \to ib \quad (29)$$

Substitution of Eq.{29} into {25} results in

$$v(z) = -2bcot\ z + a(a-1)csc^2 z \quad (30)$$

Morse potential is concluded from Eq.{27} through complexification of b and x leading to

$$\psi_n(ix) = c_n((ix)^2-1)^{-(n+a)/2} e^{-\beta_n \ \text{arccoth}\ ix}\ P_n^{((i\beta_n-n-a),(i\beta_n+n+a))}(ix) \quad (31)$$

[19]

V. Spectrum and Wave Functions of the Trigonometric Rosen-Morse Potential

Solving schrodinger' equation for the trigonometric Rosen-Morse potential as obtained in Ref [20,21] All in all, the trigonometric Rosen-Morse potential and its real orthogonal polynomial solutions open new venues in the calculation of interesting observables in both supersymmetric quantum mechanics and particle spectroscopy [20,21].

The one- dimensional schrodinger equation with the trigonometric Rosen-Morse potential reads:

$$\frac{d^2}{dz^2}R_m(z) + (2bcotz - a(a+1)csc^2 z + \varepsilon_n)R_m(z) = 0 \quad (32)$$

Our pursued strategy in solving it will be to first reshape it to the particular case of a Sturm-Liouville equation {32} of the form

$$s(x)\frac{d^2}{dx^2}F_m(x) + \frac{1}{w(x)}\left(\frac{d}{dx}s(x)w(x)\right)\frac{d}{dx}F_m(x) + \lambda_m F_m(x) = 0 \quad (33)$$

And they try to solve it by means of the so called Rodrigues representation

$$F_m(x) = \frac{1}{K_m w(x)}\frac{d^m}{dx^m}(w(x)s(x)) \quad (34)$$

Where Km is the normalization constant. And

$$\lambda_m = -m(K_1\frac{d}{dx}F_1(x) + \frac{1}{2}(m-1)\frac{d^2}{dx^2}s(x) \quad (35)$$

[21].

VI. Conclusion

In this paper we have discussed on the solution of the schrodinger equation with Rosen-Morse potential. In that case we have written radial part of schrodinger equatin with centrifugal term. Helping the factorization method and comparing it with associated Jacobi differential equation, we have obtained energy eigenvalue and wave function. We also have considered two different cases such as s-wave and Eckart potential for the Rosen-Morse.

All in all the Rosen-Morse potential and its real orthogonal polynomial solutions open new venues in the calculation of interesting observables in both supersymmetric quantum mechanics and particle spectroscopy.

References Références Referencias

1. E.Witten, Nucl. Phys. B l88, 5l3 (l98l).
2. C.V.Sukumar, J. Phys. A: Math. Gen. l8, 29l7 (l998).
3. R. De, R. Dutt, U. Sukhatme, J. Phys. A: Math. Gen. 25, L843 (l992).
4. F. Cooper, A. Khare, U. P. Sukhatme, Supersymmetry in Quantum Mechanics, Singapore: World Scientific, (200l).
5. Cooper F., Kahare A., Sukhatme U.: Supersymmetry and quantum mechanics. Phys. Rep. 251, 267 (l995).
6. M. Abramowitz, I. A. Stegun, Handbook of Mathematical Functions with Formulas, Graps and Mathematical Tables, New York: Dover, (l972).
7. C. B. Compean, M. Kirachbach, J. Phys. A: Math. Gen. 39, 547 (2006).
8. A. R. Amani, M. A. Moghrimoazzen, H. Ghorbanpour, S. Barzegaran, The ladder operators of Rosen- Morse Potential with Centrifugal term by Factorization Method, African Journal Of Mathematical Physica Volume l0 ,3l-37, (20ll).
9. Chen, G., Chen, Z. D. and Lou, Z. M., Phys. Lett. A 33l, 374 (2004).
10. P.M.Morse, Diatomic molecules according to the wave mechanics II Vibrational levels, Physicsl Review, Vol. 34, no. l, pp. 57-64, (l929).
11. M.F.Manning and N.Rosen, 'Minutes of the Middletown meeting October l4,l933',Physical Review, Vol. 44, no. ll, pp. 95l-954, (l933).
12. L. A. Girifalco, G. V. Weizer, Application of the Morse Potential to cubic metals, Phys. Rev ll4 (3). P. 687 (l959).

© 2014 Global Journals Inc. (US)

13. Samuel Dominguez-Hernandez, David J. Fernandez C., Rosen Morse Potential and Its Supersymmetric Partners, International Journal of Theoretical Physics, Volume 50, Issue 7, pp l993-200l, (200l).
14. Cliffor Benjamin Compean Jasso, Baryon spectra in a quark - diquark model with the trigonometric Rosen-Morse potential, MS thesis, Institute of Physics, Autonomous University of San Luis Potosi, Mexico, (2005).
15. C. B. Compean and M. Kirchbach, The Trigonometric Rosen-Morse Potential in the Supersymmetric Quantum Mechanics and its Exact Solutions, arxive: quant-ph/0509055v2 , 22 Sep 2005.
16. Xu Y., He S., Jia C.S.: Approximate analytical solutions of the Klein-Gordon equation with the Poschl- Teller potential including the centrifugal term. Phys. Scr. 81, 04500l (20l0).
17. Gu X.Y., Dong S.H.: Energy spectrum of the Manning-Rosen potential including centrifugal term solved by exact and proper quantization rules. J. Math. Chem. 49, 2053 (20ll).
18. Hassanabadi H., Yazarloo B.H., Zarrinkamar S., Rahimov H.: Deng-Fan potential for relativistic spinless. particles-an Ansatz solution. Commun. Theor. Phys. 57, 339 (20l2).
19. Dong S.H., Sun G.H.: The series solutions of the non-relativistic equation with the Morse potential. Phys. Lett. A 314, 26l-266 (2003).
20. Arda A., Aydogdu O., Sever R.: Scattering and bound state solutions of the asymmetric Hulth potential. Phys. Scr. 84, 025004 (20ll).
21. Soylu A., Bayrak O., Boztosun I.: Exact solutions of Klein-Gordon equation with scalar and vector Rosen-Morse-type potentials. Chin. Phys. Lett. 25, 2754 (2008).
22. Eckart C.: The penetration of a potential barrier by electrons. Phys. Rev. 35, l303 (l930).
23. Hulthen l.: Ark. Mat. Astron. Fys. 28 A (l942).
24. L. hulthen, M. Sugawara, S. Flugge, Hanbbuch der Physik, Springer (l957).
25. H.Sun, The Morse potential eigenenergy by the analytical transfer matrix method, Physics Letters A, Vol. 338, pp. 304-3l4, (2005).
26. Saxon D.S., Woods R.D.: Diffuse surface optical model for nucleon- nuclei scattering, Physical Review 95, 577-578 (l954).
27. Poschl G., Teller E.: Z. Physik (l933).
28. Schrodinger E.: Proc. Roy. Irish Acad. A46 (l940)

Table 1 : Some Potentials and Relations [22-28].

potential	relation
Rosen-Morse	$V(r) = -V_1 sech^2 \alpha r + V_2 tanh \alpha r^*$
Woods-Saxon	$V(r) = -\dfrac{V_0}{1 + exp\left(\dfrac{r-R}{a}\right)}^{**}$
Eckart	$V(r) = -k\dfrac{coshr}{sinhr} + \left(\dfrac{\mu^2}{4} - \dfrac{1}{4}\right)\dfrac{1}{sinh^2 r}^{***}$
Poschl-Teller	$V(r) = \left(\alpha^2 - \dfrac{1}{4}\right)\dfrac{1}{4sin^2\dfrac{r}{2}} + \left(\beta^2 - \dfrac{1}{4}\right)\dfrac{1}{4cos^2\dfrac{r}{2}}^{****}$
Morse	$V(r) = D_e\left(1 - e^{-a(r-r_e)}\right)^{2*****}$
Manning-Rosen	$V(r) = -k\dfrac{sinhr}{coshr} - \left(\dfrac{\mu^2}{4} - \dfrac{1}{4}\right)\dfrac{1}{cosh^2 r}^{******}$
Hulthen	$V(r) = -\dfrac{z}{\alpha}\dfrac{exp\dfrac{-r}{\alpha}}{1 - exp\dfrac{-r}{\alpha}}^{*******}$

1. **Rosen-Morse,** In this relation V_1 and V_2 denotes the depth of the potential and a is the range of the potential.
2. **The Wood-Saxon potential,** is a mean field potential for the nucleons (protons and neutrons) inside the atomic nucleus, which is used to approximately describe the forces applied on each nucleon, in the shell model for the structure of the nucleus.in this potential V_0 (having dimension of energy) represents the potential well depth, a is a length representing the surface thichness of the nucleus, and $R = r_0 A^{\frac{1}{3}}$ is the nuclear radius where $r_0 = 1.25$ fm and A is the mass number.

© 2014 Global Journals Inc. (US)

3. **Eckart,** This potential was proposed and solved by C.Eckart. A natural real domain for this potential is $]0,\infty[$
4. **Poschl-Teller,** This potential was proposed and solved by Poschl and Teller.A natural real domain for this potential is $]0,\pi[$.
5. **Morse,** In this potential r is the distance between the atoms, re is the equilibrium bond distance.
6. **Manning-Rosen,** This potential was proposed and solved by M.F.Manning and N.Rosen. A natural real domain for this potential is $]-\infty,\infty[$.
7. **Hulthen,** The Hulthen potential is a short - range potential which behaves like a Coulomb potential for small values for r and decreases exponentially for large values of r. in this potential a is the screening parameter and z is a constant which is identified with the atomic number when the potential is used for atomic phenomena.

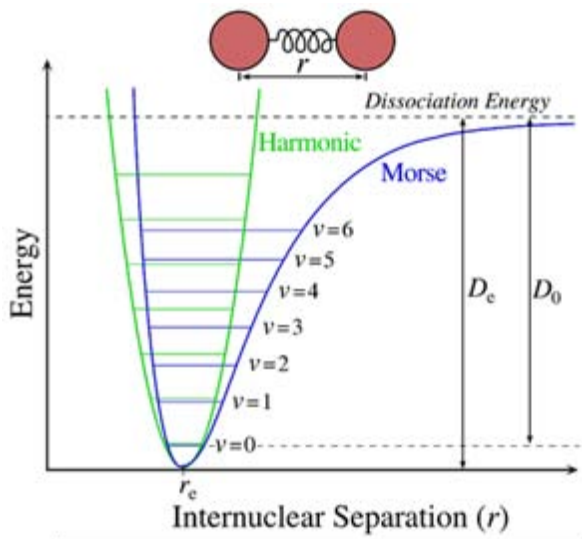


Figure 1: the Morse potential and harmonic oscillator potential

© 2014 Global Journals Inc. (US)

Global Journals Inc. (US) Guidelines Handbook 2014

www.GlobalJournals.org

FELLOWS

FELLOW OF ASSOCIATION OF RESEARCH SOCIETY IN SCIENCE (FARSS)

Global Journals Incorporate (USA) is accredited by Open Association of Research Society (OARS), U.S.A and in turn, awards "FARSS" title to individuals. The 'FARSS' title is accorded to a selected professional after the approval of the Editor-in-Chief/Editorial Board Members/Dean.

- The "FARSS" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSS or William Walldroff, M.S., FARSS.

FARSS accrediting is an honor. It authenticates your research activities. After recognition as FARSB, you can add 'FARSS' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, and Visiting Card etc.

The following benefits can be availed by you only for next three years from the date of certification:

FARSS designated members are entitled to avail a 40% discount while publishing their research papers (of a single author) with Global Journals Incorporation (USA), if the same is accepted by Editorial Board/Peer Reviewers. If you are a main author or co-author in case of multiple authors, you will be entitled to avail discount of 10%.

Once FARSB title is accorded, the Fellow is authorized to organize a symposium/seminar/conference on behalf of Global Journal Incorporation (USA). The Fellow can also participate in conference/seminar/symposium organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent.

You may join as member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. In addition, it is also desirable that you should organize seminar/symposium/conference at least once.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The FARSS can go through standards of OARS. You can also play vital role if you have any suggestions so that proper amendment can take place to improve the same for the benefit of entire research community.

As FARSS, you will be given a renowned, secure and free professional email address with 100 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders,Auto-Responders, Email Delivery Route tracing, etc.

The FARSS will be eligible for a free application of standardization of their researches. Standardization of research will be subject to acceptability within stipulated norms as the next step after publishing in a journal. We shall depute a team of specialized research professionals who will render their services for elevating your researches to next higher level, which is worldwide open standardization.

The FARSS member can apply for grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A. Once you are designated as FARSS, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria. After certification of all your credentials by OARS, they will be published on your Fellow Profile link on website https://associationofresearch.org which will be helpful to upgrade the dignity.

The FARSS members can avail the benefits of free research podcasting in Global Research Radio with their research documents. After publishing the work, (including published elsewhere worldwide with proper authorization) you can upload your research paper with your recorded voice or you can utilize chargeable services of our professional RJs to record your paper in their voice on request.

The FARSS member also entitled to get the benefits of free research podcasting of their research documents through video clips. We can also streamline your conference videos and display your slides/ online slides and online research video clips at reasonable charges, on request.

© Copyright by Global Journals Inc.(US)| Guidelines Handbook

The FARSS is eligible to earn from sales proceeds of his/her researches/reference/review Books or literature, while publishing with Global Journals. The FARSS can decide whether he/she would like to publish his/her research in a closed manner. In this case, whenever readers purchase that individual research paper for reading, maximum 60% of its profit earned as royalty by Global Journals, will be credited to his/her bank account. The entire entitled amount will be credited to his/her bank account exceeding limit of minimum fixed balance. There is no minimum time limit for collection. The FARSS member can decide its price and we can help in making the right decision.

The FARSS member is eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get remuneration of 15% of author fees, taken from the author of a respective paper. After reviewing 5 or more papers you can request to transfer the amount to your bank account.

MEMBER OF ASSOCIATION OF RESEARCH SOCIETY IN SCIENCE (MARSS)

The ' MARSS ' title is accorded to a selected professional after the approval of the Editor-in-Chief / Editorial Board Members/Dean.

The “MARSS” is a dignified ornament which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., MARSS or William Walldroff, M.S., MARSS.

MARSS accrediting is an honor. It authenticates your research activities. After becoming MARSS, you can add 'MARSS' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, Visiting Card and Name Plate etc.

The following benefitscan be availed by you only for next three years from the date of certification.

MARSS designated members are entitled to avail a 25% discount while publishing their research papers (of a single author) in Global Journals Inc., if the same is accepted by our Editorial Board and Peer Reviewers. If you are a main author or co-author of a group of authors, you will get discount of 10%.

As MARSS, you will be given a renowned, secure and free professional email address with 30 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders,Auto-Responders, Email Delivery Route tracing, etc.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The MARSS member can apply for approval, grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.

Once you are designated as MARSS, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

It is mandatory to read all terms and conditions carefully.

Auxiliary Memberships

Institutional Fellow of Global Journals Incorporation (USA)-OARS (USA)

Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).

The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

Open Association of Research Society (US)/ Global Journals Incorporation (USA), as described in Corporate Statements, are educational, research publishing and professional membership organizations. Achieving our individual Fellow or Associate status is based mainly on meeting stated educational research requirements.

Disbursement of 40% Royalty earned through Global Journals : Researcher = 50%, Peer Reviewer = 37.50%, Institution = 12.50% E.g. Out of 40%, the 20% benefit should be passed on to researcher, 15 % benefit towards remuneration should be given to a reviewer and remaining 5% is to be retained by the institution.

We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

Other:

The individual Fellow and Associate designations accredited by Open Association of Research Society (US) credentials signify guarantees following achievements:

- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
- The Fellow can become member of Editorial Board Member after completing 3yrs.
- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

"

- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone. "

Process of submission of Research Paper

The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

(II) Choose corresponding Journal.

(III) Click 'Submit Manuscript'. Fill required information and Upload the paper.

(B) If you are using Internet Explorer, then Direct Submission through Homepage is also available.

(C) If these two are not conveninet , and then email the paper directly to dean@globaljournals.org.

Offline Submission: Author can send the typed form of paper by Post. However, online submission should be preferred.

Preferred Author Guidelines

MANUSCRIPT STYLE INSTRUCTION (Must be strictly followed)

Page Size: 8.27" X 11'"

- Left Margin: 0.65
- Right Margin: 0.65
- Top Margin: 0.75
- Bottom Margin: 0.75
- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, "Abstract" word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

You can use your own standard format also.
Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

The Global Journals Inc. (US) welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals Inc. (US) is parental platform for Global Journal of Computer Science and Technology, Researches in Engineering, Medical Research, Science Frontier Research, Human Social Science, Management, and Business organization. The choice of specific field can be done otherwise as following in Abstracting and Indexing Page on this Website. As the all Global

Journals Inc. (US) are being abstracted and indexed (in process) by most of the reputed organizations. Topics of only narrow interest will not be accepted unless they have wider potential or consequences.

2. ETHICAL GUIDELINES

Authors should follow the ethical guidelines as mentioned below for publication of research paper and research activities.

Papers are accepted on strict understanding that the material in whole or in part has not been, nor is being, considered for publication elsewhere. If the paper once accepted by Global Journals Inc. (US) and Editorial Board, will become the copyright of the Global Journals Inc. (US).

Authorship: The authors and coauthors should have active contribution to conception design, analysis and interpretation of findings. They should critically review the contents and drafting of the paper. All should approve the final version of the paper before submission

The Global Journals Inc. (US) follows the definition of authorship set up by the Global Academy of Research and Development. According to the Global Academy of R&D authorship, criteria must be based on:

1) Substantial contributions to conception and acquisition of data, analysis and interpretation of the findings.

2) Drafting the paper and revising it critically regarding important academic content.

3) Final approval of the version of the paper to be published.

All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

Acknowledgements: Contributors to the research other than authors credited should be mentioned under acknowledgement. The specifications of the source of funding for the research if appropriate can be included. Suppliers of resources may be mentioned along with address.

Appeal of Decision: The Editorial Board's decision on publication of the paper is final and cannot be appealed elsewhere.

Permissions: It is the author's responsibility to have prior permission if all or parts of earlier published illustrations are used in this paper.

Please mention proper reference and appropriate acknowledgements wherever expected.

If all or parts of previously published illustrations are used, permission must be taken from the copyright holder concerned. It is the author's responsibility to take these in writing.

Approval for reproduction/modification of any information (including figures and tables) published elsewhere must be obtained by the authors/copyright holders before submission of the manuscript. Contributors (Authors) are responsible for any copyright fee involved.

3. SUBMISSION OF MANUSCRIPTS

Manuscripts should be uploaded via this online submission page. The online submission is most efficient method for submission of papers, as it enables rapid distribution of manuscripts and consequently speeds up the review procedure. It also enables authors to know the status of their own manuscripts by emailing us. Complete instructions for submitting a paper is available below.

Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5.STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

Color Charges: It is the rule of the Global Journals Inc. (US) for authors to pay the full cost for the reproduction of their color artwork. Hence, please note that, if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a color work agreement form before your paper can be published.

Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.

6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

6.1 Proof Corrections

The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

As changes to proofs are costly, we inquire that you only correct typesetting errors. All illustrations are retained by the publisher. Please note that the authors are responsible for all statements made in their work, including changes made by the copy editor.

6.2 Early View of Global Journals Inc. (US) (Publication Prior to Print)

The Global Journals Inc. (US) are enclosed by our publishing's Early View service. Early View articles are complete full-text articles sent in advance of their publication. Early View articles are absolute and final. They have been completely reviewed, revised and edited for publication, and the authors' final corrections have been incorporated. Because they are in final form, no changes can be made after sending them. The nature of Early View articles means that they do not yet have volume, issue or page numbers, so Early View articles cannot be cited in the conventional way.

6.3 Author Services

Online production tracking is available for your article through Author Services. Author Services enables authors to track their article - once it has been accepted - through the production process to publication online and in print. Authors can check the status of their articles online and choose to receive automated e-mails at key stages of production. The authors will receive an e-mail with a unique link that enables them to register and have their article automatically added to the system. Please ensure that a complete e-mail address is provided when submitting the manuscript.

6.4 Author Material Archive Policy

Please note that if not specifically requested, publisher will dispose off hardcopy & electronic information submitted, after the two months of publication. If you require the return of any information submitted, please inform the Editorial Board or dean as soon as possible.

6.5 Offprint and Extra Copies

A PDF offprint of the online-published article will be provided free of charge to the related author, and may be distributed according to the Publisher's terms and conditions. Additional paper offprint may be ordered by emailing us at: editor@globaljournals.org .

Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals Inc. (US).

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

Index

A

Anharmonicity · 36

D

Dilepton · 21, 34

E

Eigenvalues · 36, 38

H

Hadronization · 14
Hamiltonians · 36, 40

L

Leptons · 14, 15, 16, 17, 18, 20, 21, 22, 24, 28, 32, 34, 35

M

Morse · 36, 37, 38, 40, 42

P

Pseudorapidity · 30, 32

T

Tevatron · 14, 15, 16, 17, 18, 21, 22, 23, 26, 28, 30, 32, 34, 35

save our planet

Global Journal of Science Frontier Research

Visit us on the Web at www.GlobalJournals.org | www.JournalofScience.org
or email us at helpdesk@globaljournals.org

ISSN 9755896

© Global Journals