

## Curriculum Vita

**Name :** Hari P. Saha

**Present address :** Department of Physics Phone : (407) 823-2325 (work)  
University of Central Florida (407) 823-5112 (FAX)  
4000 Central Florida Blvd. e-mail : hps1@physics.ucf.edu  
Orlando, FL 32816-2385

### **Highest Academic Degree :**

- Ph.D. in Theoretical Physics, Calcutta University, 1978

### **Academic Positions :**

Professor of Physics, University of Central Florida, Orlando, 1998-present  
Associate Professor of Physics, University of Central Florida, Orlando, 1990-1998  
Assistant Professor of Physics, University of Central Florida, Orlando, 1987-1990  
Research Scientist, Supercomputer Computations Research Institute, Florida State University, Tallahassee, 1985-1987  
Visiting Research Associate, Indiana University, Bloomington, 1985  
Research Associate, Vanderbilt University, Nashville, 1982-1985  
Research Specialist, University of Minnesota, Minneapolis, 1981-1982  
Max-Planck Post-doctoral fellow, Max-Planck-Institute for Physics and Astrophysics, Munich, Germany, 1979-1981

### **Visiting Research Positions:**

#### **1) Harvard Smithsonian Center for Astrophysics**

I visited the Institute for Theoretical Atomic and Molecular Physics, Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts for two weeks from June 16 to July 31, 1993 at the invitation of Professor Alex Dalgarno. I started a research collaboration on a project " Long-range interaction for Diatomic Molecular Ions".

#### **2) Queen's University of Belfast, Northern Ireland**

1993-94 was my sabbatical year. I spent 7 weeks at Queen's University of Belfast, Belfast, Northern Ireland to perform Collaborative research work during the summer of 1993. I was invited there to combine the R-matrix method developed by the Belfast Atomic and Molecular Physics group headed by Professor P.G. Burke, FRS, and his coworkers and the MCHF (Multi-configuration Hartree-Fock) method developed by me for the calculation of Atomic and Molecular properties. Both methods have some limitations but combination of these two methods overcomes some of these limitations.

#### **3) Technical University, Munich, Germany**

In 1993 I visited the Technical University, Munich, Germany for a week at the invitation of Professor Harold Friedrich to give a colloquium talk.

#### 4) University College of London, London

In 1993 I visited the University College London at the invitation of Dr. H. Saraph.

#### 5) National Institute of Standards and Technology

During my sabbatical year I have received a Federal grant of \$ 47,316 for one year 1994-95 from the U.S Department of Commerce/ National Institute of Standards and Technology (NIST) for the project entitled "IPA Assignment Agreement-Saha" to spend my sabbatical year at NIST. I have collaborated with Dr. Y-K Kim. I have done calculations of accurate Atomic Data to use as standards.

#### 6) NASA/Goddard Space Flight Center, Greenbelt, Maryland

In 1995, I was invited by the Atomic Physics group at NASA/Goddard Space Flight Center, and discussed the possibility of collaboration.

**Awards :** Max-Planck Post-doctoral fellowship, Max-Planck-Institute for Physics and Astrophysics, 1979  
Dean's Initiative Award, University of Central Florida, 1990

**Memberships :** APS (American Physical Society)  
ACS (American Chemical Society)

**Consultant :** Chemical Physics Division, Oak Ridge National Laboratory, since 1987

#### Research Work Supervised : Graduate Students

Conrad Housand, 1994	Greg Katona 2009
Susan Hallman, 1995	
Dong Lin, 1997	
Biswadeb Roy, 1997	
Hong Shu, 2002	
Donald J. Murray, 2004	

#### Undergraduate Students

Timothy Henderson, 1990	Peter Martin 2008-2009
Clinton Boyd, 1991	Kemper Talley 2009
Don Porchia , 1992	
Lloyd Reynolds, 1994	
Yekateriwa S. Shishkina, 2002	
Yogesh Sharma, 2005	
Matthew Falanga, 2005-2006	
Ivan Chi, 2006-2007	
Christine Nguyen, 2006-2007	
Monica Bonadies, 2007	
Christopher Lorsche, 2006-2007	

#### Post-doctoral Advisees:

Dr. Scott Whitfield, 1993, now Assistant Professor at the University of Wisconsin, Eau Claire.  
Dr. Steve Schaphorst, 1994, now works in an Industry  
Dr. Alexander Menzel, 1995, now works in Germany

## PREVIOUS AND CURRENT RESEARCH COLLABORATIONS

1. **C. Denise Caldwell**, Department of Physics, University of Central Florida, now at NSF as a Program director of Atomic, Molecular and Optical Physics

**M. O. Krause**, Oak Ridge National Laboratory.

Research Project: Photoionization Spectroscopy of Atoms

2. **Dr. John Cooper**, University of Maryland, Baltimore, Maryland

Research Project : Non-dipole effects in the photo-ionization of atoms

3. **Dr. Bob Compton**, Oak Ridge National Laboratory

Research Project: Photoabsorption of Negative Ions

4. **Dr. Alex Dalgarno**, Harvard-Smithsonian Center for Astrophysics, Harvard University, Cambridge, Massachusetts.

Research Project : Long-range Interaction in Diatomic Molecular Ions

5. **Dr. D.H. Madison**, University of Missouri-Rolla, Rolla.

Research Project : Electron-Impact Ionization of atoms

5. **Dr. Steven Buckman**, and **R.W. Crompton** Australian National University, Canberra, Australia.

Research Project : Elastic Scattering of electrons from rare-gas atoms

6. **Dr. Swaraj Tayal**, Clark-Atlanta University, Atlanta.

Research Project: Excitation of Oxygen atoms by Electron Impact

## RESEARCH GRANTS AND CONTRACTS

1. Title : Studies in Photon-Atom, Photon-Molecule, and Electron-Atom Collisions  
Amount : \$ 40,000.00  
Agency : National Science Foundation  
Period : August, 1988 - July, 1990  
Role : Principal Investigator
2. Title : Studies in Photon-Atom, Photon-Molecule, and Electron-Atom Collisions  
Amount : \$ 91,500.00  
Agency : National Science Foundation  
Period : August, 1990 - July, 1994  
Role : Principal Investigator
3. Title : Photoionization and Spectroscopy of atoms and molecules  
Amount : \$ 421,986.  
Agency : National Science Foundation  
Period : June 1996 - June 2001  
Role : Principal Investigator ( as a substitute for Denise Caldwell)

4. Title : Theoretical and Computational Studies in Atomic Transitions, and Electron-Atom, Photon-Atom and Photon-Molecule Collisions  
Amount : \$ 20,000.00  
Agency: American Chemical Society, The Petroleum Research Fund  
Period : September, 1988 - August, 1990  
Role : Principal Investigator
5. Title : Photoabsorption of Atoms and Molecules  
Amount : \$ 20,000.00  
Agency: American Chemical Society, The Petroleum Research Fund  
Period : September, 1991 - August, 1994  
Role : Principal Investigator
6. Title : Theoretical and Computational Studies in Atomic Negative Ion Photodetachment  
Agency : Research Corporation of America Cross Sections  
Amount : \$ 7,000.00  
Period : May, 1988 - April, 1989  
Role : Principal Investigator
7. Title : Atomic and Molecular Photoionization, Supercomputer Time in Cyber 205 : 60 hours  
Agency : Department of Energy  
Period : November, 1987 - October, 1988  
Role : Principal Investigator
8. Title : Atomic and Molecular Photoionization, Supercomputer Time in Cyber 205 : 24 hours  
Agency : Department of Energy  
Amount (estimated) : \$27,840.00  
Period : November, 1987 - October, 1988  
Role : Principal Investigator
9. Title : IPA Assignment Agreement  
Agency : Department of Commerce/National Institute of Standards and Technology (NIST)  
Amount : \$ 47,316  
Period : August, 1994 - July, 1995  
Role : Principal Investigator
10. Title : Theoretical and Computational Studies in Atomic and Molecular Photoionization  
Supercomputer Time in Cyber 205 : 137 hours  
Agency : Department of Energy  
Amount (estimated) : \$158,920.00  
Period : May, 1987 - September, 1989  
Role : Principal Investigator
11. Title : Atomic and Molecular Photoionization, Supercomputer Time in Cray-YMP : 78 hours  
Agency : Department of Energy  
Amount (estimated) : \$ 90,480.00  
Period : October, 1989 - March, 1991
12. Title : Atomic and Molecular Photoionization, Supercomputer Time in Cray-YMP: 52 hours  
Agency : Department of Energy  
Amount (estimated) : \$60,320.00  
Period : April, 1991 - June, 1992  
Role : Principal Investigator

13. Title : Atomic and Molecular Photoionization, Supercomputer Time in Cray-YMP: 30 hours  
Agency : Department of Energy  
Amount (estimated) : \$34,800.00  
Period : July, 1992 - June, 1993  
Role : Principal Investigator
14. Title : Atomic and Molecular Photoionization, Supercomputer Time in Cray-YMP: 20 hours  
Agency : Department of Energy ,  
Amount (estimated) : \$23,200.00  
Period : July, 1993 - June, 1993  
Role : Principal Investigator
15. Title: Calculation of radial electron density function for atoms  
Agency : UCF Honors College  
Amount: \$ 2000.00  
Period : August 15 – Dec. 30, 2006  
Role : Principal Investigator
16. Title: Theoretical investigation of transition probabilities of highly charged ions in the upper atmosphere  
Agency : College of Undergraduate Studies, UCF  
Amount: \$ 3200.00  
Period : August 15 – April 30, 2006  
Role : Principal Investigator  
  
Agency : Office of Naval Research
17. Title : Study of Compound States of Negative ions using Laser beams  
Agency : Office of Naval Research  
Amount : \$ 6,500.00  
Period : May 1989 - April 1990.  
Role : Co-Principal Investigator (with Dr. R. N. Compton, Oak Ridge National Laboratory).

## **A SUMMARY OF MY RESEARCH AND ACCOMPLISHMENTS**

### **Objectives of my Research :**

My research is directed towards understanding the fundamental details of the structure and dynamics of electrons within the atoms and molecules through theoretical analysis of the interaction of photons, electrons and positrons with individual atoms and molecules in the gas phase. Over the past twenty years some of the most productive activities in atomic physics research have been in the area of photoionization and collision processes which sample the dynamics associated with continuum wave functions (unbound states) of electrons. Experimental results have stimulated development of a number of new calculational techniques for describing these systems, with a particular view toward accounting for the electron correlation and core polarization associated with the motion of an electron in the field of other electrons. To date, none of these new methods have allowed for exploitation of the most accurate technique of description of bound state systems, the Multiconfiguration Hartree-Fock (MCHF) scheme, beyond its use as a starting point for "closed" portions of the wave function. As the MCHF technique incorporates electron configuration interaction in a way superior to other techniques, the extension of this scheme to include continuum wave functions is a problem of cardinal importance in atomic theory. The primary aim of my research is devoted to just this activity.

### **How I achieve the goal :**

I have developed a method for calculation of electron continuum wave functions using the Multiconfiguration Hartree-Fock (MCHF) approach and have demonstrated that this technique is capable of treating very accurately, and completely *ab initio*, problems of involving photoionization of atoms, photodetachment of negative ions, and electron-atom scattering. This approach represents a major advance in the level of problems which can be treated. The computer codes which I devised for this method calculate wave functions for bound and continuum electrons by solving a large number of coupled second order integrodifferential equations simultaneously completely numerically self-consistently at thousands of grid points for each wave function. The approach involves evaluations of several thousands of one-electron and two-electron integrals numerically and diagonalization of very large matrices, the elements of which are vectors. The beauty of the MCHF method is that since it optimizes both excited bound and continuum wave functions simultaneously self-consistently completely *ab-initio* at each kinetic energy of the continuum electrons it takes into account both static and dynamic polarization of the target very accurately [Phys. Rev. Lett. 65, 2005 (1990)]. These polarized orbitals have been used to calculate static and dynamic polarizabilities of atoms [Phys. Rev. A 44 (1991), 5642, Phys. Rev. A 47 (1993) 2865]. The results were found to be surprisingly accurate. Many experts believe that these codes are perhaps the best for performing such calculations, particularly in cases where correlations and polarization effects are important. At UCF I have put together a computer laboratory consisting of several SUN WORK stations, and several terminals connected to it for use by my research group. All my codes are vectorized and optimized according to the architecture of the Supercomputer CRAY Y-MP.

Recently we extended the single-channel MCHF method to include multi-open channels [J. Phys. B **38** (2005) 3015]. This extension of the MCHF method opens up new areas of physics; Excitation and ionization of atoms by electron impact. In particular, the ionization of atoms by electron impact is a challenging problem in atomic, molecular and optical physics. The newly extended MCHF approach would be a powerful method to solve this challenging problem. A graduate student and me have already started to use this method to solve this yet unsolved problem. Very recently we have extended the MCHF method for bound and continuum wave functions to investigate electron impact ionization of H and He. We compared our results with experimental data and submitted an abstract to present the result at the APS-DAMOP meeting to be held on June 5-9, 2007 in Calgary, Alberta, Canada.

### **(a) Applications of the Method :**

The application of this method has led to results which show a remarkable agreement with the experimental results obtained at different laboratories. The method has been applied to a number of photoabsorption and low-energy electron-atom scattering processes and is found to produce impressive results for these processes. In particular, the technique has proven to be particularly successful in the bench-mark calculation of parameters such as scattering lengths, phase shifts for low-energy electron scattering, photodetachment cross sections for negative ions, static and frequency dependent atomic dipole polarizabilities, and electron-impact excitation cross sections of atoms

and ions. This success can be largely attributed to the fact that the technique very accurately describes the contributions of the electron correlation and polarizability to the motion of unbound electron. Its ability to treat such contributions in the bound state were already recognized. At higher energies it has proven to be possible to obtain results in very good agreement with experiment for partial photoionization cross sections and photoelectron asymmetry parameters both in the direct process and in the region of autoionization resonances, where electron correlation effects are particularly apparent [ Phys. Rev. A **47**, 3007 (1993), Phys. Rev. A **52**, 4656 (1995)]. Perhaps surprisingly, results obtained with this technique for K-shell photoionization, and Auger decay subsequent to K-shell ionization and excitation, also agree extremely well with experiment [Phys. Rev. A **49** (1994) 894]. This is likely due to the accuracy with which the technique can treat the modification of the core produced by what is an effective change in the nuclear potential seen by the electrons. MCHF calculations confirm that both cross sections and energy positions for shape resonances in the case of photodetachment of the negative helium ion [Phys. Rev. Lett. **64**,1510 (1990)] and scattering length and cross section in low-energy electron-neon scattering [Phys. Rev. Lett. **65**, 2003 (1990)] are obtainable with high accuracy, a noticeable difficulty of other schemes. According to the experts, the results obtained by the MCHF method are so accurate that they set new standards in the field of atomic physics according to the comments made by a referee of the paper [Phys. Rev. Lett. **64**,1510(1990)]. It is agreed by both theorists and experimentalists that the systems of greatest interest for future studies will be those relating to anisotropic species in which dynamic parameters will essentially be determined by the electron-electron correlation. The MCHF scheme has the potential of becoming the most powerful technique for use in examining these types of systems. Recent application of Hartree-Fock (HF) continuum wave functions to the calculation of ionization of atoms by electron impact in the distorted-wave approximation produces excellent results [J. Phys. B **35** (2002) 293]. These state of the art level calculations in atomic spectra and structure have achieved particular importance due to recent developments in plasma physics, and also the increasing volume of high quality data on stellar, interstellar and planetary spectroscopy made possible by the space program.

Emphasis is always placed on the development of innovative theoretical and computational procedures. Recently developed theoretical models clarify interpretations of experimental results and identify fundamentally important aspects of atomic and molecular electron spectroscopy and dynamics.

#### **(b) Current Research Efforts :**

I have developed a program in which the theory supports on-going experimental efforts in atomic photoionization and electron-atom scattering but is at the same time general enough to stimulate new experiments. Many research groups maintain an experimental program in photoelectron spectroscopy at the University of Wisconsin Synchrotron Radiation Center and the Advanced Light Source at Berkeley and on electron-atom collisions at the Australian National University, Canberra, Australia. The overlap between theory and experiment forms a critical component of this research program, and it is our intention to capitalize on this interaction as much as possible so that theory can suggest new experiments at the same time as it explains existing results.

#### **(c) Specific Topics of Study :**

My current research program deals with aspects of atomic photon and electron-impact excitation and ionization spectroscopy. Specific topics of recent study include : (a) Atomic photoabsorption and ionization processes in alkali and rare-earth elements and also closed shell atoms. (b) Photoionization of atoms in the excited states. (c) Collaborative experimental and theoretical determinations of photodetachment cross sections in negative ions, with particular reference to the clarification of the presence of shape and Feshbach resonances. (d) Collaborative experimental and theoretical investigations of K-shell photoionization cross section. (e) Elastic and inelastic scattering of electrons from inert-gas atoms, with particular reference to important correlation and polarization effects. (f) Extension of the MCHF + BP (Breit-Pauli) method to include relativistic effects in the continuum problem and its application to the calculation of the photoionization cross section of heavy atoms. (g) Electron-impact excitation and ionization of atoms and ions using multi-channel MCHF method.

#### **(d) Research Training :**

My research programs have great potential for providing diverse graduate and post doctoral training in the science of theoretical atomic and molecular physics. Experience in large scale computational physics using supercomputers has a wide range of applicability to research, military, economic and industrial problems.

While the computational technologies that are utilized in this research program provide an exceptional forum for student training, the scientific problems to be addressed can have a far-reaching impact. More and more the power of modern spectroscopy is being brought to bear on problems in dynamics. Experimental, computational, and theoretical study of cross sections and dynamics of photoionization of excited and aligned or oriented states will be important in helping to develop photoionization and resonance enhanced photoionization as quantitative state selective probes of dynamics. Similar studies of cross sections and dynamics of excitation and ionization of atoms by electron impact will be very useful in understanding the collision dynamics at low and intermediate energy region. The accurate theoretical work of photoionization, photodetachment and electron-atom collision processes, together with the sophisticated experimental and computational investigation, will be a powerful combination for the study of the physics and chemistry of collisions. The knowledge gained from the study of collision dynamics is increasingly being incorporated into undergraduate education to provide justification and insight into traditional physics concepts.

#### **Impact of my Research :**

This newly developed MCHF method has produced a great impact on Atomic Physics research. It resolves several difficulties encountered by other existing sophisticated methods. Its contribution, particularly in the areas of interaction of photons and electrons with atoms at very low and intermediate energies is undoubtedly exceptional. Now it is possible to predict results extremely accurately and reliably in the ab-initio manner. Results obtained by this method have wide applications.

**I have received several outstanding comments from several experts about my work.**

- 1) A referee of my paper entitled ' Theoretical Studies of the Photophysics of  $\text{He}^-(1s2s2p) \ ^4P^o$  ' published in physical Review Letters **64** (1990) 1510 , commented that the results are so accurate that ' ... they set new standards in the field.' and can be cited as a ' ... classic in the field.'
- 2) I published a paper on Low-energy electron-neon scattering [Phys. Rev. Lett. **65**, 2003 (1990)]. At that time experimental results for differential cross sections at very low energies were not available. In 1992 I received a letter from Prof. Paul Burrow of Dept of Physics and Astronomy , University of Nebraska, Lincoln that their recent experimental measurements [Shi and Burrow, J. Phys. B25, 4273 (1992)] remarkably follow my theoretical prediction. (see the copy of the letter below)





University of  
Nebraska  
Lincoln

Department of Physics and Astronomy  
Behlen Laboratory of Physics  
Lincoln, NE 68588-0111  
(402) 472-2770  
University Telex: UNL COMM LCN 484340

Jan 23, 1992

Prof. H. P. Saha  
Dept. of Physics  
U. of Central Florida  
Orlando, Florida 32816

Dear Prof. Saha,

I thought you might enjoy seeing how well our recent low energy <sup>electron beam</sup> measurements in Nean follow your theory. A paper is in preparation which I will send later.

Sincerely

Paul Burrow  
Prof.  
(pburrow@UNLINFO.UNL.EDU)

3) Recently T.L. John published an article entitled 'Reliability of absorption coefficients for free-free transitions of the negative helium ion' in J. Phys B. 28, 23 (1995) in which he used my results of electron - neon scattering and stated about my results in their paper as :

The main purpose of the present paper is to investigate the changes in  $\text{He}^-$  absorption coefficients arising from the use of Saha's data and to investigate the degree of convergence to a common set of values achieved by absorption coefficients determined from different scattering data calculated by elaborate approximations, and to try to quantify the reliability of absorption coefficients for this negative ion.

Scattering by the noble gases generally has been a very fruitful area of research. Shi and Burrow (1992) have proposed that Saha's (1989a, 1990) electron-neon results could be used as a 'secondary standard' for calibrating cross sections. They base their case on the exceptional agreement of Saha's (1989a, 1990) theoretical data, with the differential cross sections they measured using crossed-beam techniques.

An important exception has been the work of Saha (1989b, 1993) using the multiconfiguration self-consistent-field method. The most sensitive test of accord between theory and experiment is via differential cross sections (DCS), where data can be compared over a range of scattering angles for each energy. There was just about the same quality of agreement between theory and experiment in matching DCS measured by Andrick and Bitsch (1975) with the results of Saha.

The high level of agreement of the  $e + \text{Ne}$  results with experiment has been confirmed recently by the measurements and a phaseshift analysis of DCS by Gulley *et al* (1994). These results offer further corroboration to Shi and Burrow (1992) on the reliability of Saha's  $e + \text{Ne}$  data, and hence the dependability of Saha's He data, reinforcing their adoption in computing  $\text{He}^-$  free-free coefficients.

- 4) Very recently Gibson et al. published an article entitled "Elastic electron scattering from argon at low incident energies" in J. Phys. B **29**, 3177 (1996) in which they compared their recent experimental data with my theoretical results published before and commented in their paper about my results as :

Part of the motivation for the present work was provided by the excellent level of agreement with experiment that has been shown in recent applications of the multiconfiguration Hartree-Fock calculation of Saha for low energy elastic electron scattering from helium (Saha 1989b, 1993a) and neon (Saha 1989a, 1990). This method has been shown to account for electron correlation and polarization effects very accurately in an *ab initio* fashion and it assumes that spin-orbit and other relativistic effects are not significant. As this good agreement was also part of the rationale behind the proposal that the neon cross section was appropriate for use as a 'secondary standard' it was only appropriate that a thorough comparison be made in the present case with the multiconfiguration Hartree-Fock calculation for argon (Saha 1991, 1993b, 1995). In general, the level of agreement between the present data and Saha's most recent calculated DCS at all energies is very good, with the theoretical cross section lying within the experimental uncertainties at most energies and scattering angles.

- 5) In 1992 Dr. A. Temkin of NASA/Goddard Space Flight Center wrote a letter to me in response to my published paper [Phys. Rev. A **44**, 5642 (1991)] on polarizability of atoms, appreciating the new approach applied to obtain polarizability of atoms.
- 6) In 1993 Dr. Michael A. Morrison, University of Oklahoma, Norman wrote a letter to include my calculated state-of-the-art data for electron rare-gas atom scattering in a textbook which he has been writing at that time.
- 7) In 1992 Professor Alexander Dalgarno wrote a letter to me to use my calculated polarization wave functions to study long-range exchange interactions for the inert gas diatomic molecular ions. We used the wave functions and obtained very good results.
- 8) In 1991 I received an invitation by the local organizing committee (Stephen J. Buckman and Malcom T. Elford) to present a progress report of my work at the satellite meeting "The Joint Symposium on electron and Ion swarms and low energy electron scattering held at the University Park Hotel, Bond University on 18-20 July.

## RESEARCH PUBLICATIONS

### a. Article in A Book

**H. P. Saha**, K.S. Lam and T. F. George, "Recent Advances in the Theory of Chemiionization" published in 'Gas-Phase Chemiluminescence and Chemiionization' (edited by A. Fontijn), North Holland Publishing Co. 1985, pp 87-103.

### b. Published Research articles in Professional Refereed Journals.

1. Proton-hydrogen collisions by the Faddeev approach  
- **Haripada Saha**, J. Chowdhuri and N.C. Sil, Phys Rev A**14** (1976) 2372-2378
2. Asymptotic cross section for the excitation of atomic hydrogen by proton and alpha particle impact  
- **H.P. Saha** and B.C. Saha, Physics Letters, **69A** (1978) 180-184
3. Evaluation of exchange matrix elements with momentum transfer for ion-atom collisions  
- **H.P. Saha** and N.C. Sil, J. Phys. **B12** (1979) 585-594
4. Rearrangement collisions in highly excited states of atomic hydrogen  
- N.C. Sil, B.C. Saha, **H.P. Saha** and P. Mandal, Phys. Rev. A**19** (1979) 655-674
5. Electron-impact excitation of atomic hydrogen into highly excited states  
- B.C. Saha, **H.P. Saha** and N.C. Sil, J. Phys. Soc. Japan **47** (1979) 1634-1642
6. Electron capture in 3s level by proton and alpha-particle from atomic hydrogen  
- **H.P. Saha**, N. Maiti and N.C. Sil, J. Phys B**13** (1980) 327-342
7. Asymptotic behavior of cross sections for the electron impact excitation of hydrogen atom into highly excited states  
- B.C. Saha, **H.P. Saha** and N.C. Sil, Ind. J. Phys. **55B** (1981) 16-29
8. Electron impact excitation of Si X  
- **H.P. Saha** and E. Trefftz, J. Phys. **B15** (1982) 1089-1104
9. Electron Collisional excitation of S XII  
- **H.P. Saha** and E. Trefftz, Zeitschrift fur Naturforsch **37a** (1982) 744-751
10. Coronal line intensities for ions with Fine structured ground states: Si X  
- **H.P. Saha** and E. Trefftz, Astron. and Astrophys. **116** (1982) 224-231
11. A theory of Laser induced Chemiionization I. Quantal formulation  
- **H.P. Saha**, John S. Dahler and S.E. Nelson, Phys. Rev. A**28** (1983) 1487-1502
12. Calculations of coronal line intensities for Boron-like ions  
- **H.P. Saha** and E. Trefftz, Solar Phys. **87** (1983) 233-242
13. A theory of Laser induced Chemiionization II. A semiclassical limit  
- **H.P. Saha** and John S. Dahler, Phys. Rev. A**82** (1983) 2859-2867
14. Excitation of C II lines by Photoionization of neutral Carbon  
- H. Hofmann, **H.P. Saha** and E. Trefftz, Astron. and Astrophys. **126** (1983) 415-426
15. Multiconfiguration Hartree-Fock results with Breit-Pauli corrections for forbidden transitions in the  $2p^4$  configuration  
- C. Froese Fischer and **H.P. Saha**, Phys. Rev. A**28** (1983) 3169-3178

16. MCHF + BP results for electric dipole transitions in the Oxygen sequence  
- C. Froese Fischer and **H.P. Saha**, J. Phys. **B17** (1983) 943-952
17. A theory of laser induced excitation transfer and atomic association  
- **H.P. Saha**, John S. Dahler and Dumont M. Jones, Phys. Rev. **A30** (1984) 1345-1352
18. A theory of excitation transfer between Rydberg atoms  
- **H.P. Saha** and T.F. George, Mol. Phys. **55** (1985) 173-186
19. Recent advances in the theory of Chemiionization  
- **H.P. Saha**, Kai-shue-Lam and Thomas F. George, 'Gas-Phase Chemiluminescence and Chemiionization', edited by A. Fontijn (North-Holland, Amsterdam) 1985
20. Multiconfiguration Hartree-Fock results with Breit-Pauli corrections for transitions in the  $2p^2$  configuration  
- C. Froese Fischer and **H.P. Saha**, Physica Scripta **32** (1985) 181-194
21. An extension of the multiconfiguration Hartree-Fock program for continuum functions  
- C. Froese Fischer and **H. P. Saha**, Technical Report, 1983, DOE-ER-1061811, Vanderbilt University, Nashville, Tennessee 37235
22. MCHF calculation of the Oscillator strength for the  $2s2p\ ^1P^o \rightarrow 2p^2, 2snd\ ^1D$  ( $n=3-6$ ) transitions in Beryllium  
- **H.P. Saha** and C. Froese Fischer, Phys. Rev. **A35** (1987) 5240-5243
23. Photoionization of Magnesium  
- C. Froese Fischer and **H. P. Saha**, Can. J. Phys. **65** (1987) 772-776
24. Multiconfiguration Hartree-Fock calculation of the photoionization of the excited Na 4d state  
- **H.P. Saha**, M.S. Pindzola and R.N. Compton, Phys. Rev. **A38** (1988) 128-134
25. Numerical multiconfigurational Hartree-Fock studies of Atomic photoionization cross sections: Dynamical Core-Polarization effects in Atomic Sodium  
- **H.P. Saha**, C. F. Fischer and P.W. Langhoff, Phys. Rev. **A38** (1988) 1279-1285
26. Multiconfiguration Hartree-Fock calculation for the Bound-Free Photodetachment Cross section of H-  
- **H.P. Saha**, Phys. Rev. **A38** (1988) 4546-4551
27. Numerical multiconfiguration self-consistent field studies of Atomic photoionization Cross section: Dynamical core polarization effects in Atomic Potassium  
- **H.P. Saha**, Phys. Rev. **A39** (1989) 628-633
28. Threshold behavior of the M-shell photoionization of Argon  
- **H.P. Saha**, Phys. Rev. A **39** (1989) 2456-2460
29. Low energy elastic scattering of electrons from neon atoms  
- **H.P. Saha**, Phys. Rev. A **39** (1989) 5048-5061
30. Accurate ab-initio calculation on low-energy elastic scattering of electrons from helium  
- **H.P. Saha**, Phys. Rev. A **40** (1989) 2976-2990
31. K-shell photoionization of Beryllium  
- **H.P. Saha** and C. D. Caldwell, Phys. Rev. A **40** (1989) 7020-7025
32. Multiconfiguration Hartree-Fock calculation of the photoionization cross section of the Cs 7d excited state  
- **H.P. Saha**, Phys. Rev. A **41** (1990) 174-180

33. Theoretical Studies of the Photophysics of He-(1s2s2p) 4Po  
- **H.P. Saha** and R.N. Compton, Phys. Rev. Lett. **64** (1990) 1510-1513
34. Accurate ab-initio calculation of scattering length and phase shifts at very low energies for electron-neon scattering  
- **H. P. Saha**, Phys. Rev. Lett. **65** (1990) 2003-2006
35. Near threshold K-shell photoionization of Argon  
- **H. P. Saha**, Phys. Rev. A **42** (1990) 6507-6511
36. Accurate ab-initio calculations on elastic scattering of low-energy electrons by argon atoms  
- **H. P. Saha**, Phys. Rev. A **43** (1991) 4712-4722
37. Ab initio Calculation of Static Atomic Dipole Polarizabilities  
- **H.P. Saha** and C. D. Caldwell, Phys. Rev. A **44** (1991) 5642-5646
38. Multiconfiguration Hartree-Fock calculations of the photoionization of the excited N 2p<sup>2</sup>3p<sup>2</sup>S state  
- **H. P. Saha**, Phys. Rev. A **44** (1991) 6119-6122
39. Ab initio Calculation of Scattering Length and cross sections at very low energies for electron-Argon Scattering  
- **H.P. Saha**, Phys. Rev. A **47** (1993) 273-277
40. Ab-initio Calculation of Frequency-Dependent Atomic Dipole Polarizability  
- **H.P. Saha**, Phys. Rev. A **47** (1993) 2865-2870
41. Angle-resolved Photoelectron Spectrometry of Atomic Nitrogen  
- S. J. Schaphorst, S. B. Whitfield, **H.P. Saha**, C. D. Caldwell and Y. Azuma, Phys. Rev. A **47** (1993) 3007-3014
42. Accurate ab-initio Calculation of Scattering Length and Cross Sections at very Low-energies for electron-Helium Scattering  
- **H.P. Saha**, Phys. Rev. A **48** (1993) 1163-1170
43. Theoretical Studies of the K-shell Auger Spectrum of Atomic Oxygen  
- **H.P. Saha**, Phys. Rev. A **49** (1994) 894-898
44. Photoionization of the 2p Subshell of Sodium Atoms in ground and excited states  
- **H. P. Saha**, Phys. Rev. A **50** (1994) 3157-3163
45. Photoionization of atomic oxygen at the multiplet term level from 20 to 212 eV  
- S. J. Schaphorst, M. O. Krause, C. D. Caldwell, **H. P. Saha**, M. Pahler and J. Jimenez-Mier, Phys. Rev. A **52** (1995) 4656-4664
46. Ab initio Calculation on the Low energy Elastic Scattering of Electrons from Chlorine Atoms  
- **H. P. Saha**, Phys. Rev. A **53** (1996) 1553-1558
47. Theoretical Study of the valence and core photoionization of three-electron system from lithium to neon  
- **H. P. Saha** and Dong Lin, J. Phys. B **30** (1997) 1651-1667
48. Ab initio Calculation on Elastic Scattering of low energy Electrons by Sulfur Atoms  
- **H. P. Saha** and Dong Lin, Phys. Rev. A **56** (1997) 1897-1903
49. Partial Photoionization cross section and resonance structure of Br  
- Dong Lin and **H.P. Saha**, Phys. Rev. A **59** (1999) 3614 – 3621
50. Hartree-Fock treatment of exchange in (e, 2e) collisions  
- K.D. Winkler, D.H. Madison and **H.P. Saha**, J. Phys. B **32** (1999) 4617 – 4626



51. Effect of spin-orbit interaction in photoionization of bromine  
- **H.P. Saha** and Dong Lin, Phys. Rev. A **63** (2001) 042701-1-8
52. Exchange effects in low energy electron impact ionization of the inner and outer shells of argon  
- D.A Biava, **H.P. Saha**, E. Engel, R.M. Dreizler, R.P. McEachran, M.A Haynes, B. Lohmann, C.T. Whelan and D.H. Madison, J. Phys. B **35** (2002) 293 – 307
53. Photoelectron angular distribution of 3s photoionization of atomic chlorine  
- **H.P. Saha**, Phys. Rev. A (Rapid Communication) **66**, 010702-1-4 (2002)
54. Accuracy of local exchange in the calculation of continuum wavefunctions.  
- D.A. Biava, K. Bartschat, **H.P. Saha** and D.H. Madison, J. Phys. B **35** (2002) 5121-5130
55. Large electron Correlation effects in the nondipole asymmetry parameters near Photoionization thresholds  
- **H. P. Saha**, Phys. Rev. A **69**, (2004) 022712-1-5
56. MCHF studies of atomic photoionization: autoionization resonances in the partial photoionization cross sections of atomic fluorine  
- **H. P. Saha**, Rad. Phys. and Chem., **70**, (2004) 267-273
57. Extension of single channel MCHF method to include Multi-open channels  
- **H.P. Saha** and D.J. Murray, J. Phys. B **38** (2005) 3015-3027
58. MCHF Studies of Partial Photo-ionization Cross section of Atomic Fluorine  
- **H.P. Saha**, J. Phys. B **39** (2006) 1209-1222
59. Effects of final state electron-ion interactions on the fully differential cross sections for heavy-particle impact ionization of helium  
- A.L. Harris, D.H. Madison, J.L. Peacher, M.Foster, K. Bartschat, **H.P. Saha**  
- Phys. Rev. A **75**, , 2007, 031718
60. Hartree-Fock results for electron impact ionization of H atoms  
- **Hari P. Saha**  
- J.Phys. B 41, (2008) 055201-055205
61. Investigating many-electron exchange effects in electron-heavy-atom scattering  
- S Bellum, J, Lower, Z. Stegun, D.H. Madison, and **H.P. Saha**  
- Phys. Rev. A 77, (2008) 032722-1-9
62. Hartree-Fock studies of the triple differential cross section for electron impact ionization of the hydrogen atom  
- **Hari P. Saha**  
- Phys. Rev. A 77, (2008) 062705-1-6
63. Hartree-Fock results for electron impact ionization of H atoms  
- **H.P. Saha**  
- Journal of Physics B 41, 55201 (2008)
64. Theoretical Investigation of nuclear quadrupole interactions in DNA at first-principles level  
- Dip N. Mahato, Archana Dubey, R.H. Pink, R. H. Scheicher, S.R. Badu, K. Nagamine, E. Torikai, **H.P. Saha**, Lee Chow, M.B Huang, T.P. Das  
- Hyperfine Interactions, 181, 81 (2008)
65. Low-energy electron-impact Ionization of the helium atom using the multiconfiguration Hartree-Fock method

- H.P. Saha**
  - Phys Rev A 82, 042703 (2010)
66. Target Correlation and Polarization effects on the electron impact ionization of He atoms
- **Hari P. Saha**
  - J. Phys. B 44, 065202 (2011)
- 67 Extension of Multi-configuration Hartree-Fock method to allow Double Photoionization of Atoms
- **Hari P. Saha**
  - Phys. Rev. A 87, 042703 (2013)
68. “Accuracy of 3DW approach for electron Impact Ionization of Neon”
- Sadek Amami, Don Madison, **Hari Saha**, Thomas Pflueger, Xueguang Ren, Arne Senftlebeu and Alexander Dorn
  - Proceeding’s, ICPEAC 2013, XXVIII International Conference on Photonic, Electronic and Atomic Collisions, July 24-30, LanZhou, China.
- 69 Ionization of Helium by Electron Impact : Test of Screening Potential in the final state
- **Hari P. Saha**
  - Submitted to Journal of Physics B, (Atomic, Molecular and Optical Physics ), Referee’s report came. Referee suggested few corrections. Revised manuscript is submitted recently.

#### Professional Research Presentations at Professional Conferences and Meetings

1. Excitation of hydrogen atom by electron impact
  - **H.P. Saha**, B.C. Saha and N.C. Sil
  - Abstracts of papers, National Symposium on molecular spectroscopy and molecular collision processes: Centenary Celebrations 1976; Indian Association for the Cultivation of Science; Calcutta - 700032, India.
2. Electron impact excitation of Si X
  - **H.P. Saha** and E. Trefftz
  - Abstract of papers, Third topical conference of the American Physical Society on ' Atomic processes in high temperature plasma at Louisiana State University, Baton Rouge, Louisiana, U.S.A., February, 1981.
3. Electron impact excitation of Si X and line intensity ratios in the Solar Corona
  - **H.P. Saha** and E. Trefftz
  - Abstract of papers, First European conference on Atomic Physics at Heidelberg, West Germany, 1981.
4. Numerical MCSCF studies of Photoionization and Photodetachment Cross sections
  - **H.P. Saha** and P.W. Langhoff
  - Bull. Am. Phys. Soc., Vol. **31**, No 5 (1986) 931, Joint meeting of the division of Atomic, Molecular, and Optical Physics and the division of Chemical Physics:18 - 20 June, 1986, Eugene, Oregon, U.S.A. organized by the American Physical Society (Oral).
5. Confirmation of an experimental zero in an  $l \rightarrow l-1$  photoionizing transition of the excited Na 4d state
  - **Hari P. Saha**
  - Bull. Am. Phys. Soc, Vol. **33**, No. 4 (1988), 1035, Joint meeting of the division of



Atomic , Molecular, and Optics, 18 - 21 April, 1988, Baltimore, Maryland, Organized by the American Physical Society.

6. Near threshold behavior of the M-shell photoionization of Argon  
- **Hari P. Saha**  
- Bull. Am. Phys. Soc., Vol. **34**, No. 5 (1989) 1412, Annual meeting of the Division of Atomic, Molecular and Optics/ American Physical Society meeting in Ontario, Canada, 17 - 19, May 1989.
7. Partial cross sections for K-shell photoionization of Beryllium.  
- **Hari P. Saha** and C. Denise Caldwell  
- Bull. Am. Phys. Soc., Vol. **34**, No. 5, (1989) 1412, Annual meeting of the Division of Atomic, Molecular and Optics/ American Physical Society meeting in Ontario, Canada 17- 19 May, 1989.
8. Dynamical Core-Polarization effects in photoionization cross sections of Atomic Potassium.  
- **Hari P. Saha**  
- Abstracts of contributed papers, presented at the XVI th International Conference on the Physics of Electronic and Atomic Collisions, July 26 - August 1, 1989 in New York.
9. Photodetachment of Negative Helium Ion He- ( $4P^{\circ}$ )  
- **H. P. Saha**  
- Bull. Am. Phys. Soc., Vol **35**, No. 5, (1990) 1163, Annual meeting of the Division of Atomic, Molecular and Optical Physics/American Physical Society meeting in Monterey, California May 21 - 23, 1990.
10. Ab-initio Calculations on Elastic Scattering of Low-energy Electrons by Argon atoms  
- **H. P. Saha**  
- Bull. Am. Phys. Soc., Vol. **36**, No. 4, (1991) 1284, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Washington, D.C., April 22-24, 1991.
11. Photoionization of the Excited State of Nitrogen  
- **H. P. Saha**  
- Abstracts of contributed papers, presented at the XVII th International Conference on the Physics of Electronic and Atomic Collisions, July 10 - 16, 1991, at Brisbane, Australia.
12. Ab initio calculations of Scattering length and Cross sections at very low energies for electron-argon scattering  
- **H. P. Saha**, Bull. Am. Phys. Soc., Vol. **37**, No. 3, (1992) 1093, Annual meeting of the Division of Atomic, Molecular and Optical Physics/American Physical Society meeting in Chicago, May 20-22, 1992.
13. Theoretical studies of the K-shell Auger spectrum of atomic Oxygen  
- **H. P. Saha**, Bull. Am. Phys. Soc., Vol. **38**, No. 3, (1993) 1095, Annual meeting of the division of American Physical Society in Reno, Nevada, May 17-19, 1993.
14. Accurate ab-initio calculation of scattering length and cross sections at very low energies for electron-helium scattering  
- **H. P. Saha**, Abstracts of contributed papers, presented at the XVIII th International conference on the Physics of Electronic and Atomic Collisions, July 21-27, 1993 at Aarhus, Denmark.
15. Inner-shell Photoionization in an Excited Sodium Atom  
- **H. P. Saha**, Bulletin of the American Physical Society, Vol 39, No. 2, (1994) 1223, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Crystal City, Virginia, April 18 - 22, 1994.

16. Partial Photoionization Cross Sections for Atomic Oxygen  
- S. J. Schaphorst, C. D. Caldwell and **H. P. Saha**, Bull. Am. Phys. Soc., Vol. **39**, No. 2, (1994) 1221, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Crystal City, Virginia, April 18-22, 1994.
17. Ab initio Calculation on Elastic Scattering of Low Energy Electrons by Chlorine Atoms  
- **H. P. Saha**, Bull. Am. Phys. Soc., Vol. **40**, No. 4, (1995) 1294, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Toronto, Ontario, Canada, May 16-19, 1995.
18. Transition Energies and Oscillator Strengths for transitions between different states in the aluminum isoelectronic sequence  
- **H. P. Saha**, Bull. Am. Phys. Soc., Vol. **40**, No. 4, (1995) 1334, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Toronto, Ontario, Canada, May 16-19, 1995.
19. Binary-Encounter-Dipole Model for Electron-Impact Ionization  
- W. Hwang, Y.-K. Kim, M. E. Rudd and **H. P. Saha**, Abstracts of contributed papers, presented at the XIX th International Conference on the Physics of Electronic and Atomic Collisions, July 26 - Sept. 2, 1995, in Vancouver, Canada.
20. Ab initio Calculation on Elastic Scattering of Low Energy Electrons by Sulfur atoms  
- **H. P. Saha** and Dong Lin, Bulletin of the American Physical Society, Vol. 41, No. 4, (1996) 1554, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Ann Arbor, Michigan, May 15-18, 1996.
21. Cross sections and Angular Distributions of Electrons photodetached from the Negative ion of Boron  
- **H. P. Saha** and Dong Lin, Bull. Am. Phys. Soc., Vol. **41**, No. 4, (1996) 1420, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Ann Arbor, Michigan, May 15-18, 1996.
22. Effect of Spin-Orbit Coupling in Photoionization of Atomic Br  
- **H. P. Saha** and Dong Lin, Bull. Am. Phys. Soc. Vol. **42**, No. 2, (1997) 1022, Annual meeting of the Division of Atomic, Molecular and Optical Physics / American Physical Society meeting in Washington, D.C., April 18 - 21, 1997.
23. Effect of Spin-Orbit Interaction in Photoionization of Atomic Br  
- **Hari P. Saha** and Dong Lin, Bull. Am. Phys. Soc., Vol. **45**, No. 3, P 75, 2000, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Storrs, Connecticut, June 14 – 17, 2000.
24. Photoelectron Angular Distributions of 3s Photoionization of Atomic Chlorine  
- **Hari P. Saha**, Bull. Am. Phys. Soc., Vol. **46**, No. 3, P 37, 2001, Annual meeting of the Division of Atomic, Molecular and Optical Physics/American Physical Society meeting in London, Ontario, Canada, May 16-19, 2001.
25. Exchange effects in low Energy electron Impact ionization of the inner and outer shells of Argon  
- D.A. Biava, **H.P. Saha**, E. Engel, R.M. Dreizler, R.P. McEachran, M. A. Haynes, B. Lohmann, C.T. Whelan and D.H. Madison, Bull. Am. Phys. Soc., Vol. **46**, No. 3, P 67, 2001. Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in London, Ontario, Canada, May 16 – 19, 2001.
26. Exchange effects in low Energy electron Impact ionization of the inner and outer shells of Argon  
- A. Prideaux, D.A. Biava, D.H. Madison, R.P. McEachran, **H. Saha**, E. Engel, R. Dreizler,

- M.A. Haynes and B. Lohmann, Proceedings of Contributed papers, XXII International Electronic, Conference on Photonic, and Atomic Collisions (ICPEAC), July 18-24, 2001, Santa Fe, New Mexico, USA.
27. Correlation Effects in Non-dipole parameters near atomic photoionization Thresholds  
- **H.P. Saha**, Bull. Am.Phys. Soc., Vol. **47**, No. 3, P28, 2002, at the Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Williamsburg, Virginia, May 28 – June 1, 2002
  28. Accuracy of Local Exchange Approximation for calculating Continuum Electron Wave function.  
- D. A. Biava, **H.P. Saha**, K. Bartschat, D.H. Madison, Bull. Am. Phys. Soc., Vol. **47**, No. 3, P39, 2002, at the Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Williamsburg, Virginia, May 28 – June 1, 2002.
  29. Extension of the MCHF method to Include multi-open channels  
- **H.P. Saha** and D.J. Murray, Bull. Am. Phys. Soc., Vol. **48**, No. 3, P 47, 2003, at the Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Boulder, Colorado, May 21-24, 2003.
  30. Application of recently extended MCHF method for multi-open channels to the excitation of atoms and ions  
- **H.P. Saha**, Bull. Am. Phys. Soc., Vol. **49**, No. 3, P 69, 2004, at the Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Tucson, Arizona, May 25-29, 2004.
  31. Excitation of ground state of oxygen to a metastable state by electron impact  
- **Hari P. Saha** and Swaraj Tayal, Bull. Am. Phys. Soc., Vol. **50**, No. 3, P 85, 2005, at the Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Lincoln, Nebraska, May 17-21, 2005.
  32. MCHF Studies of Partial Photoionization Cross section of atomic Fluorine  
- **Hari P. Saha**, Bull. Am. Phys. Soc., Vol. **50**, No. 3, P 88, 2005, at the Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Lincoln, Nebraska, May 17-21, 2005.
  33. Electron impact excitation of oxygen to a metastable state  
- **Hari P. Saha** and Swaraj Tayal, Bull. Am. Phys. Soc., Vol. **51**, No. 3, P 89, 2006, Annual meeting of the Division of Atomic, Molecular and Optical Physics/American Physical Society meeting in Knoxville, Tennessee, May 16-20, 2006.
  34. Polarized orbitals obtained from the scattering calculations used as pseudo states  
- **Hari P. Saha**, Bull. Am. Phys. Soc., Vol. **51**, No. 3, P 36, 2006, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Knoxville, Tennessee, May 16-20, 2006.
  35. Effect of Exchange Distortion on Spin Polarized Electron-Xenon Scatterin  
- Z. Stegen, D.H. Madison, **H. Saha**, K. Bartchat, R. Panajotovic, S. Bellm, J. Lower, Eric Weigold, Bull. Am. Phys. Soc., Vol. **51**, No. 3, P 113, 2006, Annual meeting of the Division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Knoxville, Tennessee, May 16-20, 2006.
  36. Theory of Nuclear Quadrupole Interaction in Trifluoro-Aminoboranes [ $\text{BF}_3\text{-NH}_{3-x}(\text{CH}_3)_x$ ]  
- Mahendra K. Mahanti, Nehu, A. Dubey, **H.P. Saha**, Lee Chow, R.H Scheicher, R.H. Pink, Dipon Mahato, M.B. Huang, T.P. Das, Bull. Am. Phys. Soc. **50**, No. 1, 2006, March meeting of Condensed Matter Physics/American Physical Society meeting in Baltimore, Maryland, March 13-17, 2006.

37. Unrestricted Hartree-Fock Investigation of the Electron Distribution on the Hemo System in Azidohemoglobin  $^{57}\text{mFe}$  and  $^{14}\text{N}$  Hyperfine Interactions.  
 - A. Dubey, **H.P. Saha**, Lee Chow, R.H. Scheicher, N. Sahoo, R.H. Pink, Dip N. Mahato, M.B. Huang, T.P. Das, Bull. Am. Phys. Soc. **50**, No. 1, 2006, March meeting of Condensed Matter Physics/American Physical Society meeting in Baltimore, Maryland, March 13-17, 2006.
38. Importance of Relativistic effects and Exchange between Bound and continuum electrons on Electron impact ionization of Xenon  
 - Z. Stegun, D.H. Madison, **H.P. Saha**, K. Bartschat, Bellum J. Lower, R.P. McEachran, E. Weigold  
 - Presented at the 59 th Annual Gaseous Electronics Conference, October 10-13, 2006, Columbus, Ohio.
39. Effects of Electron Exchange in Fully Differential cross sections for Charged particle Ionization  
 - A.L. Harris, M. Foster, J.L. Peacher, D.H. Madison, **H.P. Saha**, K. Bartschat  
 - Presented at the 59 th Annual Gaseous Electronics Conference, October 10-13, 2006, Columbus, Ohio.
40. Investigation of Bonding in the  $\text{BF}_3-\text{H}_2\text{O}$  Complex  
 - Archana Dubey, **H.P. Saha**, Lee Chow, R.H. Pink, Dip N. Mahato, M.B. Huang, T.P. Das, R.H. Scheicher, N.K. Mahanti  
 - Abstract submitted for the March 2007 meeting of the American Physical Society in Denver, Colorado, March 5-9, 2007
41. Study of Electronic Structures of Nucleobases and Associated Nuclear Quadrupole Interactions for  $^{14}\text{N}$ ,  $^{17}\text{O}$  and  $^2\text{H}$  in A-DNA and B-DNA  
 - R.H. Scheicher, Dip N. Mahato, R.H. Pink, M.B. Huang, T.P. Das, Archana Dubey, **H.P. Saha**, Lee Chow  
 - Abstract submitted for the March 2007 meeting of the American Physical Society in Denver, Colorado, March 5-9, 2007
42. Hartree-Fock Study of the Heme Unit of deoxy hemoglobin for Hyperfine Interactions and Vibrational Properties  
 - T.P. Das, Ramani Lata, R.H. Pink, Dip N. Mahato, Archana Dubey, **H.P. Saha**, A.F. Schulte, Lee Chow, R.H. Scheicher, N.B. Maharajan, N. Sahu.  
 - Abstract submitted for the March 2007 meeting of the American Physical Society in Denver, Colorado, March 5-9, 2007
43. Extension of the MCHF method to investigate electron impact ionization of atoms near threshold  
 - **H.P. Saha**  
 - Abstract submitted at the 38 th Annual meeting of the division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Calgary, Alberta, Canada, on June 5-9, 2007.
44. MCHF Studies of electron impact ionization of helium atoms  
 - **H.P. Saha**  
 - Bull. Am. Phys. Soc. Vol. 53, No,7, 94 (2008), division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in State College, Pennsylvania, May 27-31, 2008
45. Effects of Polarization and Electron Correlation on the Electron impact Ionization of Helium Atom  
 - **H.P. Saha**  
 - Bull. Am. Phys. Soc. Vol. 54, No,7, 133 (2009), division of Atomic, Molecular and Optical Physics/ American Physical Society meeting in Charlottesville, Virginia, May 19-23, 2009

46. MCHF studies of Electron impact Ionization of helium atom  
 - **H.P. Saha**  
 - Bulletin of the American Physical Society, Vol. 53, No. 7, 94 (2008), Division of Atomic, Molecular and Optical Physics/American Physical Society meeting at State College, Pennsylvania, May 27-31, 2008.
47. Accuracy of the Gamow Factor for Approximating the PCI (Post Collision Interaction) in Electron-Impact Ionization of Atoms  
 - D.H. Madison, **H.P. Saha**, B. Lohmann, M.A. Stevenson and L.R. Hargreeves  
 - Abstract submitted for the GEC08 Meeting of the American Physical Society
48. The Electronic Investigation of Singlet and Triplet States of Oxyhemoglobin by Hartree-Fock Procedure and Associated Hyperfine Interaction.  
 - Archana Dubey, S.R. Badu, R.H. Scheicher, N. Sahoo, R.H. Pink, A. Schulte, **H.P. Saha**, Lee Chow, K. Nagamine, T.P. Das  
 - Bulletin of the American Physical Society, Vol. 53, No. 1, (2008), March meeting of the Condensed Matter Physics/American Physical Society in New Orleans, Louisiana, March 10-14, 2008.
49. Investigation of Trapping Positions for Beryllium Atom in C60 Fullerene and Electron Densities at  $^7\text{Be}$  Nucleus.  
 - Lee Chow, Archana Dubey, **H.P. Saha**, Gary S. Collins, R.H. Scheicher, N.B. Maharjan, S.R. Badu, R.H. Pink, M.B. Huang, T.P. Das  
 - Bulletin of the American Physical Society, Vol. 53, No. 1, (2008), March meeting of the Condensed Matter Physics/American Physical Society in New Orleans, Louisiana, March 10-14, 2008.
50. N.B. Maharjan, S.R. Badu, Archana Dubey, R.H. Scheicher, R.H. Pink, Lee Chow, A. Schulte, **H.P. Saha**, T.P. Das.

**Electronic Structure and the Magnetic Hyperfine Interactions in Heme Unit of Metmyoglobin**

Bulletin of the American Physical Society, Vol. 53, No. 1, (2008), March meeting of the Condensed Matter Physics/American Physical Society in New Orleans, Louisiana, March 10-14, 2008.

51. S.R. Badu, A. Dubey, K. Ramani Lata, R.H. Scheicher, R.H. Pink, A. Schulte, Lee Chow, **H.P. Saha**, K. Nagamine, T.P. Das

**Hartree-Fock Investigation of Electronic Structure and Associated Properties of Heme Unit in Deoxyhemoglobin**

Bulletin of the American Physical Society, Vol. 53, No. 1, (2008), March meeting of the Condensed Matter Physics/American Physical Society in New Orleans, Louisiana, March 10-14, 2008.

52. R.H. Scheicher, Archana Dubey, S.R. Badu, **H.P. Saha**, R.H. Pink, K. Nagamine, E. Torikai, Lee Chow, T.P. Das

**Hartree-Fock Cluster study of Electronic Structures and Nuclear Quadrupole Interactions in Solid Nucleobases.**

Bulletin of the American Physical Society, Vol. 53, No. 1, (2008), March meeting of the Condensed Matter Physics/American Physical Society in New Orleans, Louisiana, March 10-14, 2008.

53. T.P. Das, Archana Dubey, R.H. Scheicher, S.R. Badu, R.H. Pink, K. Nagamine, E. Torikai, **H.P. Saha**, Lee Chow, M.B. Huang,

**Nuclear Quadrupole Interaction Study as a Probe of Interaction between Nucleobases and Sugar Rings and Phosphate Groups in DNA**

Bulletin of the American Physical Society, Vol. 53, No. 1, (2008), March meeting of the Condensed Matter Physics/American Physical Society in New Orleans, Louisiana, March 10-14, 2008.

54. **H.P. Saha**

**Effects of Polarization and Electron Correlation on the Electron impact Ionization of helium atom**

Bulletin of the American Physical Society, Vol. 54, No. 7, 94 (2009), Division of Atomic, Molecular and Optical Physics/American Physical Society meeting at the University of Virginia, Charlottesville, Virginia, May 19-23, 2009.

55. **H.P. Saha**

**Convergence of the solution of Hartree-Fock equations with two continuum wave functions in the same configuration**

Abstract submitted for the American Physical Society meeting at the University of Houston, Houston, Texas, May 19-23, 2010.

56. S.R. Badu, R.H. Pink, Archana Dubey, R.H. Scheicher, **H.P. Saha**, K. Nagamine, E. Torikai, Lee Chow, M.B. Huang, T.P. Das

**First Principles Study of Muonium Trapping and Associated Hyperfine Interactions in Nucleobases in Single and Double Chain DNA and Solid Nucleobases**

Bulletin of the American Physical Society, Vol. 54, No. 1, (2009), March meeting of the Condensed Matter Physics/American Physical Society in Pittsburg, Pennsylvania, March 16-20, 2009.

57. T.P. Das, R.H. Pink, S.R. Badu, Archana Dubey, R.H. Scheicher, **H.P. Saha**, Lee Chow, M.B. Huang

**First Principles Study of Nuclear Quadruple Interactions in Single and Double Chain DNA and Nucleobases**

Bulletin of the American Physical Society, Vol. 54, No. 1, (2009), March meeting of the Condensed Matter Physics/American Physical Society in Pittsburg, Pennsylvania, March 16-20, 2009.

58. **H.P. Saha**

**Electron impact Ionization of helium atom**

Bulletin of the American Physical Society, Vol. 55, No. 5, 58 (2010), Division of Atomic, Molecular and Optical Physics/American Physical Society meeting in Houston, Texas, May 25-29, 2010.

59. Don Madison, Sadek Amami, Adam Upshaw and **Hari Saha**

## **How Good is Theory for Predicting the Absolute Value of (e-2e) Ionization Cross Sections ?**

Bulletin of the American Physical Society, 63 rd Annual Gaseous Electronics Conference and 7 th International Conference on Reactive Plasmas, Vol. 55, No. 7 , (2010), in Paris, France, October 4-8, 2010

### **60. H.P. Saha**

Extension of Multi-configuration Hartree-Fock method to allow Double Photoionization of Atoms

Bulletin of the American Physical Society, Vol. 55, No. 5 , 58 (2011), Division of Atomic, Molecular and Optical Physics/American Physical Society meeting in Atlanta, GA, June 13-17, 2011.

### **61. Hari P. Saha**

#### **Electron Impact ionization of Helium Atom**

Bulletin of the American Physical Society, Vol. 56, No. 5 , 58 (2011), Division of Atomic, Molecular and Optical Physics/American Physical Society meeting in Atlanta, GA, June 13-17, 2011.

### **62. Hari P. Saha**

#### **Double Photoionization of Helium Atom using Effective charges**

**Abstract** submitted to the American Physical Society, 43 rd Annual meeting of the Division of Atomic, Molecular and Optical Physics, Anaheim, California, June 4-8, 2012

### **63. Hari P. Saha**

#### **Electron Impact ionization of Helium atom using Screening potential**

**Abstract** submitted to the American Physical Society, 43 rd Annual meeting of the Division of Atomic, Molecular and Optical Physics, Anaheim, California, June 4-8, 2012

### **64. Importance of final state electron-electron interactions in the Triple Differential Cross Sections for Electron Impact**

- S.M. AMAMI, DON MADISON, Missouri ST, **HARI SAHA**, University of Central Florida, THOMAS PFLUEGER, XUEGUANG REN, ARNE SENFTLEBEN, ALEXANDER DORN, JOACHIN ULLRICH, Max-Planck-Institute for Nuclear Physics.
- **Abstract** submitted to the American Physical Society, 43 rd Annual meeting of the Division of Atomic, Molecular and Optical Physics, Anaheim, California, June 4-8, 2012

### **65. Low Energy (e-2e) experimental and theoretical 3-dimensional study of Neon**

- S.M. AMAMI, DON MADISON, Missouri ST, **HARI SAHA**, University of Central Florida, THOMAS PFLUEGER, XUEGUANG REN, ARNE SENFTLEBEN, ALEXANDER DORN, JOACHIN ULLRICH, Max-Planck-Institute for Nuclear Physi
- **65 th Gaseous Electronic Conference**, October 22-26, 2012, the University of Texas at Austin.

### **66. Double Photoionization of helium Atoms using Screening Potential**

- **H.P. Saha**  
Bulletin of the American Physical Society, Vol. 58, No. 5 , (2013), Joint meeting of APS, DAMOP and the CAP, DAMOP, Canada, Quebec City, Canada, June 3-7, 2013

67. Application of the Screening Potential Approach for electron Impact Ionization of rare-gas atoms  
**Hari P. Saha**  
 Bulletin of the American Physical Society, Vol. 58, No. 5, (2013), Joint meeting of APS, DAMOP and the CAP, DAMOP, Canada, Quebec City, Canada, June 3-7, 2013
68. Application of Polarization effects in the Initial state and the Screening potential in the final state the ionization of helium by electron impact  
 - **HARI SAHA,**  
 - Abstract submitted, 45 th Annual APS DAMOP meeting, June 2-6, 2014, Madison, Wisconsin.
69. Double Photoionization of helium atom using effective charges  
 - **HARI SAHA**  
 - Abstract submitted, 45 th Annual APS DAMOP meeting

## INVITED LECTURES

1. University of Central Florida, Orlando, Florida, on August 15, 2006 "Excitation of Oxygen atom to a meta-stable state".
2. University of Central Florida, Orlando, Florida, April 2, 2005. "State of the Art calculation of Photon-atom and Electron-Atom collisions"
3. University of Central Florida, Orlando, Florida, on July 15, 2004 "Multiconfiguration Hartree-Fock method for Low energy Electron-atom Collisions"
4. University of Georgia, Georgia, Athens, Georgia, on March 25, 2002. "Photoionization of atoms and electron-atom scattering at low energies"
5. Laboratory for Atomic, Molecular and Optical Physics, University of Missouri-Rolla, on April 2, 1998, "State of the Art calculation of Photon-atom and Electron-Atom collisions"
6. University of Central Florida, Orlando in October, 1995, "State of the Art calculation of Photoionization of Atoms and Electron-Atom Scattering"
7. National Institute of Standards and Technology (NIST), Gaithersburg, Maryland, February 1995, "Multiconfiguration Hartree-Fock method for Continuum Wave functions".
8. Technical University, Munich, Germany, in July, 1994. "Photoionization of Atoms and Electron-Atom Scattering"
9. INSTITUTE FOR THEORETICAL ATOMIC AND MOLECULAR PHYSICS, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138, June, 1993. "Photoionization of Atoms and Photodetachment of Negative Ions and Electron-Atom Collisions".
10. The joint Symposium on Electron and Ion Swarms and Low Energy Electron Scattering" which was held at the Australian National University, Canberra, Australia, July 21, 1991. 'Low Energy Electron-atom Scattering'
11. Naval Post-Graduate School, Monterey, California, USA, May, 1990, "Numerical Calculation of the Photodetachment of Negative Helium Ions".
12. University of Central Florida, Orlando, USA, April, 1988. "Photodetachment of negative hydrogen Ions" "Photoionization of atoms and Photodetachment of negative Ions".



13. University of Central Florida, April 1987, “ Photoionization of atoms and Photodetachment of Negative Ions “
14. Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA, January, 1987, “ Dynamical core-polarization effects in the Photoionization of Sodium atoms “.
15. Florida State University, Tallahassee, Florida, USA, September, 1986. “ Photoionization of Sodium Atoms “.
16. Florida State University, Tallahassee, Florida, USA, March, 1986. “ Theoretical Studies on Photoionization of Atoms ”
17. Max-Planck-Institute for Physics and Astrophysics, Munich, West Germany, April, 1980 “ Electron impact excitation of Si+9 “.
18. Southern Illinois University at Carbondale, Carbondale, Illinois, U.S.A, March, 1981 “ Electron impact excitation of Si+9 and line intensity ratios in the solar corona “.
19. Washington University, St. Louis, U.S.A. , March, 1981. “ Excitation of S+11 by electron impact ”.
20. University of Minnesota, Minneapolis, U.S.A., September, 1982. ”A theory of Laser induced chemiionization “.
21. Vanderbilt University, Nashville, Tennessee, U.S.A., October, 1984.” Neutralization of ions near a metal Surface “.
22. Indiana University, Bloomington, Illinois, U.S.A., September, 1985. “ An extension of the multiconfiguration Hartree-Fock program for continuum functions “.
23. Indiana University, Bloomington, Illinois, October, 1985.” Neutralization of protons near a Tungsten surface “.

## **PROFESSIONAL SERVICE ACTIVITIES**

### **Referee for Journals :**

Physical Review and Physical Review Letters, since 1988.

Journal of Physics B, Atomic and Molecular Physics, since 1992.

Physica Scripta, since 2006

### **Reviewer of Grant Proposals :**

1. National Science Foundation (NSF), since 1989.
2. National Science Foundation (NSF) Professional Opportunities for Woman in Research and Education Program (POWRE)
3. National Science Foundation (NSF) International Programs-Africa, Near East and South Asia 2001-2004
4. American Chemical Society, The Petroleum Research Fund,

since 1988.

5. National Research Council (NRC)  
since 1997