



85th Birthday Celebration of Professor Arun K. Basak: The Legacy of a Dedicated, Nobel Emeritus Physics Professor

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Basak Sir in his Office at the Physics Department at RU

This manuscript is submitted for publication in the special volume of the Varendra International Journal for Interdisciplinary Research (VIJIR), dedicated for celebrating the 85th Birthday anniversary of Professor Arun K. Basak, an iconic academic leader and a noble emeritus Physics Professor at the University of Rajshahi (RU), Rajshahi, Bangladesh. This is a tale of a young Physics Graduate Student, who met Dr. Arun Kumar Basak in 1967 as a graduate (M. Sc.) student at RU. This composition includes my survival story during the 1970 war and documented my thorough journey involving the collaboration with the Atomic Physics Group, headed by Basak Sir, at RU. It is almost five decades since we met and this untold 50 years old story had started even before the birth of the present Bangladesh.

I was born and brought up in a very remote village called Majumderkhil, Rangunia, Chittagong (Present name: Chattogram). Chattogram is the second-largest city and the principal seaport of Bangladesh. Located on the Karnaphuli River near the Bay of Bengal, it still serves as the commercial heart of the country, handling over 70% of Bangladesh's export-import trade. With Mathematics distinction, I matriculated from the Dacca Board in 1962 and was admitted to the Chittagong Gov't College. After obtaining my B. Sc (Dacca University), I got a chance to continue graduate studies at the Department of Physics at Rajshahi University in 1967. I was not an honor student, but admitted as a M. Sc student there. In M. Sc (I) we had no classes with Basak Sir. In the M. Sc part-I exam I obtained First Class and stood first. In M. Sc (II) students with distinctions were selected to pursue research in addition to their regular courses. I was

selected to do research in Nuclear Emulsion Group, headed by Dr. M. M. Kasim, Head sir Dr. A. Husain, A. K. Basak, and M. M. Rahman. That research opportunity was a turning point in my academic career. We had regular group meetings for discussing the progress of our research assignments. Basak Sir taught us Quantum Mechanics in the final year, in 1968. Those student days remain transparent in my mind even today. I would like to add, my research accomplishments were phenomenal; at the end of the semester, I was able to complete three research papers which were published in various journals. In preparing those manuscripts, Basak sir's unique contributions were unparalleled. Those published papers are:

1. M.M. Kasim, A. Husain, A.K. Basak, M.M. Rahman, A.S. Mondal, P. Ali and B.C.Saha, „*Study of the Non-mesonic Decay of Hypernuclei Produced by K Mesons of 3.0 GeV/c Momentum, The Nucleus (PAEC, Karachi) 6, 138 (1969).*..
2. M.M. Kasim, A. Husain, A.K. Basak, M.M. Rahman, A.S. Mondal, P. Ali and B.C. Saha, *An Example of Δ Li9Hypernucleus*”, *Scientific Researches (Dacca) 7, 140 (1970).*
3. A. Husain, M.M. Kasim, A.K. Basak, A.S. Mondal, P. Ali and B.C. Saha, *The Lifetime of Heavy Spallation Hyperfragments*”, *The Nucleus (PAEC, Karachi) 8, 55 (1971).*

After my M. Sc exam, I was offered a lecturer position at the Physics Department at the Rangunia Degree College (it is now Rangunia Gov't College), Rangunia, Chittagong. Here I should add that my High School *Rangunia Model High School* was upgraded to the Degree College and our head master Mr. Santosh Bhushan Das was the founding Principal of that College. He asked me to join the college and start teaching Physics even before finishing the Thesis viva. From the external examiners the report of the thesis evaluation should arrive at the University before a viva date can be scheduled. I was employed there till the war between the East and West Pakistan broke out in 1970. Being in my twenties, we were the prime targets of the West Pakistani military armies. Needless to say, finding no other alternatives I had to leave home, leaving behind my parents, siblings, and close relatives. I was accompanied by my maternal cousin elder brother; we had to avoid all the connected routes to Chittagong downtown since West Pakistani militaries had captured all transportation avenues. Therefore, we were forced to take an alternative risky escaping route via Rangamati, the capital of the Chittagong Hill District. From Rangamati and onwards our journey was not on road but over water as the Kaptai Lake was completely filled. The figure below reveals our escaping route from Rangunia home to Rangamati to Khagrachari. Thus

the Steamer, a mini Ship, was the only commuter device from Rangamati to Kagrachari. We were on board on that ship along with many young men who were heading to India for training (the Mukti jodhya) to save our motherland from the West Pakistani arrogant forces. After touching many hill towns our ship arrived at Khagrachari, almost 100 kilo-meter from the nearby Indian boarder at Sabrom. The very hilly roads surrounded by various endangers species was covered only by foot. Starting at early dawn before the sunrise our tedious journey on foot was ended when we reached at the Indian boarder at Sabrom at night. We registered in an Indian refugee camp there. The map shown below depicts the route more clearly.



Along the way, we saw a few known faces and a few days later we have arrived at Agartala, the capital of the Tripura district. I stayed with my cousin brother, Mr. Saroj Kumar Saha, there for almost a month. His dad, the late Lal Mohan Saha, was my father's eldest brother and by profession was a Primary School teacher. My uncle lost his father, our Grandpa, at an early age and was compelled to take care of the family consisting of my father, aunty and grandma. Due to this calling, my uncle sacrificed his higher study dream and in doing so, compelled us to study more seriously. His uncompromised commands did at times include wild restrictions with no choice other than to obey. My uncle had four sons and one daughter. I have one younger brother and three sisters and I was the eldest. We were a joint family consisting of fifteen members. After obtaining his B. Sc from the Chittagong Government College in 1964, my uncle's youngest son, Mr. Saroj Kumar Saha, migrated to Agartala, Tripura, India. He was a Science teacher in a local High School at Agartala. With his help, a travel plan for my move to Calcutta (the British named it, but now it called Kolkata) was made. I had to borrow money from him to cover travel expenses for the train journey. Our scheduled train started at Dharma Nagar and went through many important cities like, Shillong, Guwahati, Coach Behar, Siliguri, Jalpaiguri, and a few more, the following map shows those cities explicitly. After two days the train reached at Sealdah Main Rail Station at Kolkata. It was almost dark, and I had no idea about that big city and did not know where I could stay that night. I met a close friend at the railway station who came to receive his own relatives; he was a chemistry professor at our college; although he was senior to me but we both were from the same Majumderkhil village. He asked me to follow him to his

brother's home where I spent the night. Next day, I went to my father's maternal uncle's (Mama) residence, a rented two bed rooms apartment. At that time, my grandpa (Dadu) was a retired civil engineer, graduated from Glasgow University, UK. Dadu was the project manager of the Damoder Valley project and a proud father of two brilliant daughters; elder one was a Gynecologist and the younger one was a Chemist with a Ph. D. from the Calcutta University. She was a Professor at Nil Ratan Medical College and was in charge of all Chemistry Labs. I would like to add here that neither my Dadu nor my aunties saw me after I was born. However, my Grandma (Dida) who was also from my same village saw me when I was a few months old. This was how an unrooted fallen tree branch found its way to survive. It was very distressing, Dadu was retired and they were depended heavily on their daughter's earnings. I tried to get a teaching position at local High School as all 12th grades school required science teachers. In addition, I also was looking for pursuing research opportunity at the University. I knew at that time that only a few reputed Indian University offered Ph. D. degrees.



I found Basak Sir's name enlisted in the refugee book at Calcutta and I stayed in touch with him. I found an advertisement seeking graduate students to pursue research for obtaining Physics Ph. D. degree. The advertisement was from the Indian Association for the Cultivation of Science (IACS), needless to say, it was that institute where Professor C. V. Raman did his Nobel obtaining research works and Professor Satyendra Nath Bose was a retired Physics professor there. With my aunty, Dr. Minati Saha, I went to IACS for obtaining an application form. On our way back, my aunty met with another renowned Chemist, Professor P. C. Dutta, the chair of the Organic Chemistry at IACS. Prof. Dutta mentioned that he was also a Rajshahi Government College student. During our conversation, somehow I received his kind attention. He asked me to put his name for recommendation on my referee list. I applied accordingly for that fellowship and after a few days received a letter for interview. I was luckily selected for a fellowship but it was eligible for Indian citizen only. The Theoretical Physics Department of IACS offered me the Research position but the fellowship clearance should come from the Indian Council of Science & Technology (ICST), New Delhi. I gladly accepted the offer although it was not quite the same as my M.Sc. training. The research work involved for this fellowship was theoretical study. After not

receiving any clearance information of that scholarship, I again met with Prof. Dutta to discuss the issue. He suggested I should request the IACS Registrar for authorizing him to handle the case during his next ICST visit. Per his suggestion, I went to the Registrar Office to obtain that authorization letter which I gave to Prof. Dutta. During his next visit to Delhi, Prof. Dutta has managed to remove the hurdle and cleared the situation, after which my scholarship payment was timely and regular. And that turning point was a remarkable step for my research career in India. With such a gift I was able to complete my Ph. D. from the Calcutta University in 1976. I was invited to give a talk at a National Conference held at Dhaka University, Bangladesh in 1977. There I met with many of my RU teachers, among them Profs. Husain, Raquib, Basak, Rahman and a few more. Basak sir has just returned from Birmingham, UK after obtaining his Ph. D. in the low energy nuclear physics. He was very impressed with my presentation on the theoretical research works on Atomic Scattering. I went to RU on that time to collect my original M. Sc. certificates. At that time Professor Raquib was the Vice Chancellor of RU. Before the visa expiration date, I returned to Calcutta and started my first post-doctoral research with my thesis advisor and mentor Professor N. C. Sil at IACS. We have developed a new and noble technique to evaluate the scattering amplitude of transition to high Rydberg states using the First Born Approximation (FBA) for electron (positron) – atom (& Molecules) and proton – atom (& Molecule) scattering. In 1978, the Indian University Grants Commission offered me the National Post-doctoral Fellowship and I continued working with Prof. Sil at IACS. Under his guidance, I was able to deduce the FBA inelastic scattering amplitude for any arbitrary excited states involving electron, positron, proton and alpha particle impact of H scattering into a suitable one dimensional form which was solved numerically. Earlier the inelastic scattering investigation were confined to a few low lying states as the tedious repeated differentiation rendered a great constraint. The final state (the excited states) wave function was described by a Laguerre Polynomial that helps us to obtain the scattering amplitude in a closed form by employing a contour integration. And that was a breakthrough, even for very large quantum number, $n \rightarrow \infty$ we were able to calculate the scattering amplitude analytically and has applied this in many problems. I tried for a faculty position at Calcutta and the surroundings but with no luck.

In 1979, I got an offer from the Flinders University of South Australia, Adelaide, Australia. It was my first overseas offer. Before leaving Calcutta I got married Krishna who was my sweet heart and class mate at RU. I reached Adelaide alone and joined the Atomic Physics Group headed by the late Prof. Ian E. McCarthy. We developed an optical potential in momentum space where the contributions from both real and imaginary parts were included explicitly. Using the imaginary part of this potential alone one can evaluate the ionization cross sections easily. But the real part became very important to incorporate excited states in the calculation. With that idea the convergent close coupling approximation was developed and had phenomenal success afterward but I was not there at that time. I made five publications during my stay at Flinders. I would like to add here that our son, Paban, was born there at Adelaide. From Australia in 1982 with my 15 months old son we moved to the United states, instead of returning back to India, to joined the Yale University at New Haven, Connecticut for another post-doctoral assignment. It was only for a short period where my advisor Prof. Arvid Herzenberg and myself have developed the virtual state

mechanism which we successfully applied to the electron polar molecule scattering process. Our published paper published at J. Phys. B is shown below:

A Herzenberg and **B C Saha**, "The virtual electron state in a weakly polar molecule," J. Phys. B16, 591 (1983).

In my next move, I went from the Northeast coast (New Haven) to the middle of America, the Oklahoma. I was offered a Research Scientist position at the Physics Department, University of Oklahoma (OU), Norman, USA in 1982. I worked with Prof. Michael A. Morrison for almost seven years and generated a few outstanding publications on the collision of electron and positron with molecular Hydrogen and Nitrogen. We have resolved a long standing dispute between two experimental groups regarding the vibrational excitation of $e^- - H_2$ scattering and published our findings in the *Physical Review Letters*. A new polarization potential for $e^- - N_2$ scattering was generated and applied successfully to reproduce the experimental cross section. In 1985 with Professor Morrison's help, OU administration has sponsored me to obtain the Green card allowing me to remain employed in USA. I am very thankful to Prof. Morrison who forwarded a memo to the OU Provost stating that *Dr. Saha is an excellent scientist who has made significant and unique contributions to his research assignments at OU*. OU did sponsor me for applying to obtain the Green Card from the USA Government. Finally in 1987 we got our green card allowing us to remain permanently in USA and be employed.



Mrs. Devika Basak with Sir in their residence

During the Christmas break of 1987, I took my family to visit India and Bangladesh since my both parents and in-laws had not seen their grandson till his born at Adelaide, South Australia. We first went to Chattogram and stayed a few days over there and then we took our son to meet his maternal grandparents at Sagarpara, Rajshahi. The house of my in-laws at Sagarpara (Krishna's home, where she born and bought up) is just a few blocks apart from

Basak sir's house. My son had fun with Basak sir and we had a few dinner in his house when Boudi made all delicious foods, drinks and sweets by herself. A photo depicting Sir and our beloved Boudi is added here for your perusal. I am clearly remembering her cordial, loving and very affectionate hospitality and getting very emotional and becoming more sadden due to her early passing. We all miss her very dearly.

We all returned to USA and were staying at Oklahoma again. In addition to my research work I was trying for a teaching position. OU did offer me a visiting Assistant Professor position for only 9 months (August 16, 1988 through May 15, 1989). Due to fund cuts this assignment, however, had not been extended further. My future again became very uncertain, covered by a huge dark cloud. My son was in his 2nd grade. My great concern was if I am unemployed how could I continue with his early education? I did not pursue the graduate study offered by the Department of Radiological Science at OU, but I moved to Rice University at Houston, Texas to continue my challenging research works. At Rice, I joined Professor Neal F. Lane who was the group leader of the Theoretical Atomic and Molecular Physics. In the past I had done theoretical works on electron-molecule collisions, but at Rice I had to shifted my interest to *heavy particle* collisions involving the inelastic processes in collisions between atoms and ions and molecules. The techniques are very different from those due to electron collisions investigations. Two different processes were particularly challenging: (i) quasi-elastic collisions of highly-excited ("Rydberg") atoms in collisions with rare-gas atoms and (ii) selective excitation in charge exchange collisions of highly stripped ions with both atoms and molecules. In the case of "Rydberg" atom collisions, the validity of the semi-classical approaches to the collision problem as well as the dependence of various state changing collisions on the orientation and alignment of the initial atom in a non-spherical state was examined thoroughly. The latter work was published in the *Physical Review Letters*.

B C Saha and N F Lane, "*Alignment and Geometric Effects on Intra collisional Interference Structure in Cross Sections for inelastic collisions involving Rydberg Atoms*", *Phys. Rev. Letters* **72**, 3487 (1994).

In the Fall of 1994, I joined the Physics Department at Florida A&M University (FAMU) as a Visiting Professor; it was not a tenure earning position as I was lacking teaching experience compared to my research accomplishments. I took that challenge and have accepted that teaching position at FAMU. From Rice U, Houston I alone drove to Tallahassee, FL to join FAMU, keeping my wife and son at Houston as my only son was starting 9th grade at a good High School in Houston.

My father, Dr. Chinta Haran Saha, passed away in November of 1994. I went alone to my Chattogram home to complete the death rituals. Before returning to the States, I visited Rajshahi and met with Basak Sir and our beloved Boudi at their residence at Sagarpara, Rajshahi. At the end of the 1995 spring semester, the chair of the Physics department asked me to apply for a tenure-track position at FAMU. After completing all due formalities, I was selected as a tenure track Assistant Professor in the Physics Department there at FAMU in 1995 academic year. A new phase of my career had started since then. The monumental task

started *how to obtain tenure ship in the next 5 years*. In addition to teaching the regular assignments for both grad and undergrad courses, one also should bring external funds for pursuing research that could help to publish research papers in reputed journals. I was fortunate to obtain external grants from i) Research Corporation and ii) NASA for my research works. I hired a post-doctoral fellow to work on those projects. I attended two International Conference on Photonic, Electronic, and Atomic Collisions (ICPEAC) in 1995 and 1997 at Whistler, Canada and Vienna, Austria respectively to presented our research results. Those international conference presentations are kept below:

1. **B C Saha** and C A Weatherford, "Theoretical rotational and vibrational cross sections for low energy e^+ - N_2 scattering", *Abst XIX th ICPEAC*, Canada, p357, (1995).
2. **B C Saha** and C. A. Weatherford, "Electron Capture From Excited Alkali Atoms by Protons at Low Energies: Effects of Initially Aligned Orbitals", *Abst XX th ICPEAC*, Vienna, Austria, WE174, (1997).
3. **B C Saha**, "Quenching of Na (4p) by Low-Energy He and H_2 ", *Abst XXth ICPEAC*, Vienna, Austria, FR050, (1997).

At FAMU, I published 15 papers with my post-doctoral, *Dr. Anil Kumar* and they are

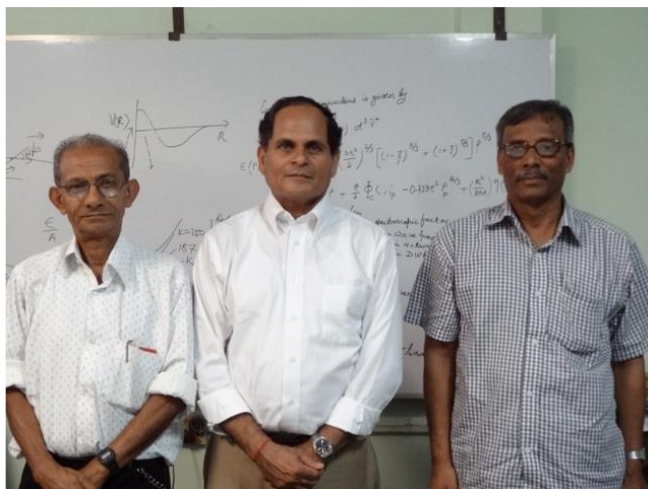
1. **B. C. Saha** and A. Kumar, "Electron capture by partially stripped ions of C and N from ground state Na: A low-energy study", *J. Phys. B* **31**, L613 –L620 (1998).
2. A. Kumar, **B. C. Saha** and C. A. Weatherford, "Single electron capture cross sections by alpha particles from ground state K (4s) and Rb (5s): A molecular-state approach", *Int. J. Qu. Chem.* **70**, 909 - 917 (1998).
3. A. Kumar, and **B. C. Saha**, "Role of projectile core in slow ion-molecule collisions: A molecular-state close-coupled approach", *J. Phys. B* **31**, L937 – L945, (1998).
4. A. Kumar and **B. C. Saha**, "State-selective charge transfer in slow collisions of partially stripped He like ions with H_2 ", *Phys. Rev. A* **59**, 1273 - 1283(1999).
5. A. Kumar, **B. C. Saha**, A. A. Khan, V. Kumar, S. K. Verma and K. K. Prasad, "Depopulation of low-Rydberg Na atoms in collision with rare gases: A molecular-state treatment ", *Int. J. Qu. Chem.* **73**, 307 - 316 (1999).
6. **B. C. Saha** and A. Kumar, "Quantum and semi-classical depopulation cross sections: Collisions of low-Rydberg alkali atoms with ground state He atoms", *Ind. J. Phys* **73B**, 687 - 694(1999).
7. A. Kumar, **B. C. Saha**, C. A. Weatherford and S. K. Verma, "A systematic study of Hornbeck Molnar ionization involving Rydberg alkali atoms", *J. Mol. Structure (Theochem)*, **487**, 1 - 9 (1999).
8. **B. C. Saha** and A. Kumar, "State-selective capture cross sections in slow collisions of fully and partially stripped ions with molecular hydrogen: A progress report", *J. Mol. Structure (Theochem)*. **487**, 11 - 25 (1999).
9. **B. C. Saha** and A. Kumar, "Low-energy single electron capture cross sections in $C6^+ / C4^+$ - (Na(3s) and $N7^+ / N5^+$ - Na(3s) collisions : A molecular state approach ", *Int. J. Qu. Chem.*, **75**, 385 – 398 (1999).

10. **B. C. Saha** and A. Kumar, "Quenching of Li low- n Rydberg atoms by ground state He atoms: A low-energy molecular state calculation ", Phys. Rev. A **61**, 032709 (-1-5) (2000).
11. **B. C. Saha**, A. Kumar, V. Kumar and S. K. Verma, "Preferential population of $n = 2$ state in the low-energy Li^{3+} -He collisions: A molecular state study", J. Mol. Structure (Theochem), **529**, 141 -148 (2000).
12. **B. C. Saha**, A. Kumar and S. K. Verma, "Production of KRB^+ : The relative efficiency of two channels", J. Mol. Structure (Theochem), **529**, 15 - 19 (2000).
13. **B. C. Saha** and A. Kumar, "State-changing collisions of low-Rydberg Na atoms with ground state He atoms: a low-energy study involving spherical and non-spherical initial target states", Int. J. Qu. Chem, **80**, 1011 - 1023 (2000).
14. **B. C. Saha** and A. Kumar "Slow electron capture by H^+ from initially excited p -states of alkali- metal atoms", Phys. Rev. A **64**, 012721 (-1—12) (2001).
15. **B. C. Saha** and A. Kumar, "Role of initial orbital alignment in $\text{H}^+ + \text{K} (4p)$ collisions at low energy", Int. J. Qu. Chem, **85**, 382 - 391, (2001).

All these progresses involving Research, Grand & Services, and creative activities were essential for tenure ship application. In 2000, I received the tenure ship and was promoted to Associate Professor at the Department of Physics at FAMU. I became a full Professor in 2003 and was selected the Associate Chair for the Department. In that year, I was also nominated to be the Director of the FAMU Physics Graduate committee. My Sabbatical Leave of absence from FAMU for a year was approved and in the Fall of 2003, I started my sabbatical leave by joining ITAMP of the Harvard University, Cambridge, Massachusetts as a visiting fellow. During the Christmas break our son, Paban, joined us in Cambridge and at the end of 2003 we drove back to Tallahassee. Paban left for his medical School at Washington University at St. Louis, MO. Krishna and I then drove to Los Alamos National Laboratory (LANL) as a visiting Faculty. During this time Basak Sir has asked me to be a Thesis examiner for one of his Ph. D students, who was his first Atomic Physics Graduate student. I agreed and did receive the thesis at LANL timely. The thesis entitled, "Theoretical determination of the electron impact single ionization cross sections for neutral atoms and ions" was submitted by Mr. Mohamad Alfaz Uddin in January 2004. I recalled the thesis evaluation report was rushed to the Registrar office at RU on time. The thesis has few important results on ionization phenomena. And that created a new avenue for us and a collaborative project to pursue theoretical investigations on scattering phenomena at RU was initiated immediately.

At RU *The Atomic Collision Theory Group* was created. Our joint investigations can easily be categorized into three distinct parts.

The **1st part** was primarily to provide (and discover) easy way to obtain results for the electron impact break up processes. We devised a few analytical models and made record breaking progress on that arena. Using semi-empirical, semi-classical, and analytical methods we have calculated electron impact Atomic and Ionic Ionization cross sections at various energies. Inner shell ionization including K -, L -, and M -shell ions were also investigated.



A picture taken in 2008, Dr. Alfaz Uddin (3rd in the row), Arun Kumar Basak Sir extreme left and the author in the middle.

The **2nd part** describes the most elaborate procedure we developed to investigate the elastic cross sections due to either electron (e^-) or positron (e^+) with neutral (& ionic) atomic targets for projectile energies from 10 eV to few MeV. Many elements of the periodic table have been used as targets for calculations the differential (DCS) as well as the total cross sections (TCS) including the relativistic corrections. The theoretical description of these scattering processes demands an exact calculation of the lepton scattering states. This was accomplished by solving the relativistic Dirac equation using partial wave analysis. The interaction potential V is expressed by a complex optical potential comprising of static, exchange, polarization and absorption potential. The imaginary part of the latter potential represents the absorption of beam particles into inelastic channels during scattering process. The static, exchange and absorption potentials are short range in nature but the polarization has long range component. For different targets, they all have different structures, thus a general expression is rather impossible. In addition to DCS and TCS we also have investigated the Sherman Function to find the spin asymmetry features explicitly. The role of critical minima in DCS along with the location of polarization points in S surrounding the proximity of those minima including their deeps have critically and thoroughly been studied. The profound outcomes found in our studies make the proposed OPM method very friendly in generating accurate cross section data required for many technologies and industries.

The last approach was designed to create a bridge mapping smoothly the low-energy and high energy results. We, however, had to use two different theoretical approaches both of which are based on the partial-wave analysis; one involved atomic potentials at low to intermediate energies a (OPM) and the other employed the nuclear potential (NSA) at higher energies when solving the Dirac equation. I obtained a letter, from Professor Dorris H. Jakubassa-Amumdsen, at the Mathematics Institute, University of Munich, Germany, where she proposed, “*Would you be interested in a collaboration concerning an investigation of the energy dependence of the differential cross section and the Sherman function for elastic*

electron and positron scattering at fixed angle, extending over 7-8 decades” ? We made a remarkable progress with her expert and generous help. For all studied targets her high energy results up to GeV helped to identify an overlap region where both low and high energy results agreed very smoothly. This prescription had been implemented not only to calculate the DCS but also the Spin asymmetry properties for an energy range from 10 eV to GeV. Seven book chapters so far have already been published with our results. The comparison of our results with the experimental findings for electron scattering and Sherman Function show good agreement.



The current leader of the group, Prof. A. K. Fazlul Haque (3rd from the left), is seen in this picture along with Basak sir, myself and Prof. Uddin.

Over last three decades, I jointly published papers with Basak Sir in peer-reviewed journals. Among the 41 publications, there are 7 review articles, published as Book Chapters. I was the corresponding author for almost all of them. The complete list of all these papers are presented in Arun Sir's CV published in this journal. It is a pleasure to add here that three students (Dwayne Joseph, Edwin Quashie and Yaye Badjo) have obtained their Ph. D. in Physics at FAMU under my supervision. Also there were another 2 postdoc (Dr. Zhao and Dr. Guevara) worked in my group at FAMU. Our published papers are shown below:

1. L. B. Zhao, D. C. Joseph, **B. C. Saha**, H. P. Liebermann, P. Funke, and R. J. Buenker, "Comparative study of quantal and semiclassical treatments of charge transfer between O^+ and He", *Phys Rev A* **79**, 034701 (-1 – 4) (2009).
2. L. B. Zhao, B. C. Saha, and M. L. Du, "Circular Rydberg states of atomic hydrogen in an arbitrary magnetic field", *Comm. In Theo. Physics*, **56**, 48 (2011).
3. L. B. Zhao, **B. C. Saha**, and M. L. Du, "Calculation of excited states of He atoms in a strong magnetic field", *Comm. In Theo. Physics*, **57**, 1059, (2012).
4. D. C. Joseph, **B. C. Saha**, J.P. Gu, H. P. Libermann, P. Funke and R. J. Buenker, " $(SiH)^{3+}$ Quasi-Molecule in the Adiabatic Representation", *Molecular Electronic Structure Theory*, **67**, 21 (2013).

5. **Bidhan C. Saha**, Nicolais L. Guevara, John R. Sabin, Erik Deumens and Yngve Ohrn, “Charge exchange collisions of slow C^{6+} with atomic and molecular H”, *Eur. Phys. J. D.* **70**, 88 (2016).
6. Edwin E. Quashie, **Bidhan C. Saha**, Alfredo A. Correa, “Electronic Band Structure Effects in the Stopping of Protons in Copper”, *Phys. Rev. B* **94**, 155403 (2016).
7. Edwin Quashie, **Bidhan C. Saha**, Xavier Andrade, and Alfredo A. Correa, “Self-interaction Effects on charge-transfer collisions”. *Phys. Rev. A* **95**, 042517(2017).
8. D. C. Joseph and **B. C. Saha**, “Charge Exchange in Slow Collisions of Si^{3+} with Hydrogen atom: Molecular-orbital Close coupling Approaches in the Adiabatic representation”, *Advances in Quantum Chem.*, **84**, 74 – 94 (2020).
9. Yaye H. Badjo, B. Boates, **Bidhan C. Saha**, and Stanimir A. Bone, “Liquid Silane at High Pressure”, *Phys. Rev. B* xxx (2024).

All conference presentations (Nationals: 107 & International 45) are not shown here. Now I have 125 peer reviewed publications including 7 Book Chapters.

We had two time NSF’s funding for the Center of Research Excellence in Science and Technology (CREST) projects. In 2012, FAMU offered me the Outstanding Research Award for my brilliant research accomplishments. In recognition of my tireless and effective leadership to mentor young people, in 2015 I was presented with FAMU’s First Faculty Graduate Mentoring Award. In 2019, I was elected a Fellow of the Bangladesh Academy of Sciences. This honor was the recognition of my extensive collaborations with Bangladesh scientists at RU, thus contributing to the scientific development of Bangladesh. In 2020, I was elected a fellow of the American Physical Society.

There were two more trips I took to RU. Krishna also accompanied me there as well. In 2008, I went to RU to give an invited talk at a conference. A few pictures of that conference are kept below. My classmate and a very close friend, Professor Sayeedur Rahman Khan, the ex-Vice Chancellor of RU was also an invited speaker in that conference. On the right panel Prof. Sayeedur Rahman Khan is seen beside me.



Krishna and I were invited to Sayeedur's house for a dinner with their lovely family. Qumrunesa (Mrs. Khan), Krishna (Mrs. Saha) and I were class mates and we all obtained our M. Sc. from the Physics Department at RU. It was an interesting gathering where we had quality times with delicious foods prepared by Qumu (Mrs. Khan). We were very grateful for their kind and cordial hospitality. They are the proud parents of two daughters and a boy with whom we met there.



(From left) Krishna, Qumu and myself

In 2007-2008 Basak Sir was visiting the Southern Illinois (SIUC) to continue his joint NSF funding project with Professor F. Bary Malik on the nature of the interaction between two nuclei at short distances. His recent *Physical Review* (C113, 034623, 2026) publication has earned wide reputation. Our son got married in 2007 just after receiving his match for residency at the University of Pennsylvania in internal medicine. He obtained his MD from the Washington University at St. Louis, MO. During that period Basak Sir was only a five hours car trip (350 miles away) from St. Louis. He was invited to attend the wedding ceremony--*if he agreed, I could drive to bring him to the event*-- but unfortunately he declined to attend. We missed him very much. After internal medicine residency, Paban applied to cardiology fellowship and was accepted as a cardiology Fellow at Northwestern Memorial Hospital. Finally he pursued a second fellowship in Cardiac Electrophysiology. He currently works at Mercy Hospital in St. Louis as an Electrophysiologist and the director of the Atrial Fibrillation Program, Electrophysiology at Mercy Hospital St. Louis. He lives with his family in Saint Louis, MO.

The other time Basak Sir invited me to give a seminar talk in the Physics Department at RU. I had an opportunity to meet with many young and bright students interested in Physics. It was an enjoyable visit. I recall I met with Prof. A. K. M. Azaharul Islam who also attended my talk. By the way, I was also Azahar Sir's student. Unfortunately that was my last visit to RU, Bangladesh.

Before closing, I would like to convey my *Pronam* to him and sincerely wishing him a good health. For a distinguished research career, quality teaching, devotion in institutional capacity building, nation building, and public science awareness activities in Bangladesh, Basak Sir has been recognized with most of the top awards in Bangladesh. Also he accolades Bangladesh Academic of Sciences Gold Medal and the Silver Jubilee Award, attested to a lifetime of service and excellence. For outstanding contributions to education and research he has been awarded Banglar Bag Padak 2025 Award. I am grateful, humbled, honored and feeling very proud to have his guidance and unconditional blessings throughout my academic career. I remain grateful for his continued supports and unconditional love. It is my sincere hope that our recent joint efforts would bestow upon him the APS Fellowship pretty soon. And with God's help this could be my "*Guru Dakshina*" গুরু দক্ষিণা। Finally, I would like to add a picture taken during my 2008 visit. Although this is two decades old picture, but it properly reflects the true *lifestyle* of a dedicated renowned teacher whose 85th birthday we are celebrating to day.

Happy Birthday!

