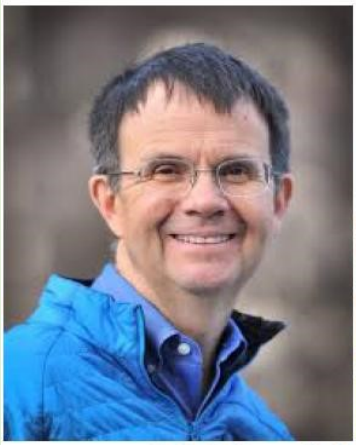

2021: 100 years of Physics in Bangladesh

International e-Conference on Physics 2021

www.bdphso.org

5 – 7 February 2021

Time: 19:00 to 23:00 (Bangladesh Standard Time)

Venue: Zoom Online Platform

Book of Abstracts

Jointly Organized

by

Bangladesh Physical Society (BPS)

University of Dhaka

Frontiers of Physics of USA

Conference Organizing Committee

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From Convener's Desk

Welcome Message

I am extremely proud to share that an international e-conference on Physics-2021 is going to be jointly organized by Department of Physics, University of Dhaka (DU), Bangladesh Physical Society (BPS) and Frontiers of Physics (FOP), USA from 5th to 7th February, 2021 using the online platform Zoom.

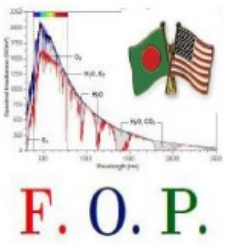
The Physics Department is one of the founding departments of the University of Dhaka which began its long and glorious journey in 1921. Prof. S.N. Bose worked as a teacher in this department and proposed the world-famous Bose-Einstein statistics. Since its establishment, it has significantly contributed to the development of physics. On the other hand, BPS, a nonprofit membership organization, is working to disseminate that knowledge of physics through its outstanding research journal (Bangladesh Journal of Physics), scientific meetings, outreach programs, advocacy, and international activities. Recently, FOP has extended its hand to popularize physics education among the students and young scientists of Bangladesh.

I am very excited to inform you that the keynote speaker, Prof. Eric A. Cornell, Nobel Laureate in Physics 2001, will deliver his speech on 'A Century of Bose Statistics, Including a Quarter-Century of Bose-Einstein Condensation'. Along with the keynote speech, this e-conference includes three plenary sessions and a US-Bangladesh education collaboration program which, I believe, will be a great opportunity for the young scientists and collaborators who want to pursue their study and research in the USA. Due to the pandemic situation, this conference is limited to the plenary sessions only.

This conference will focus on the various aspects of physics from physics of nanoparticles to astro-physics, for example, 100 years of Bose-Einstein statistics, topological matters, thermoelectricity, black holes etc. I hope the participants will enjoy the physics of the mentioned topics a lot which will enrich their knowledge in related research.

I would like to take this opportunity to thank the Honorable Minister of MoE, Vice-Chancellor of DU, US Ambassador, National and International speakers, Delegates, Members of the organizing committee (DU, BPS and FOP), Members of the sub-committee for their dedication and hard work for making such an excellent scientific program successful. I believe that acquired output from this conference will positively contribute to the development of basic and applied sciences in both the local and international arena.

Prof. Dr. Mesbahuddin Ahmed
Convener, Organizing Committee
International e-Conference on Physics -2021



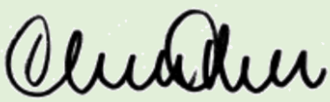

Message from the Frontiers of Physics: Prof. Sultana N. Nahar and Dr. Charles W. Clark, USA

Dear Fellow Physicists and students,
Assalamu alaikum, Adab,
We are honored to be part of you and to organize the e-Conference on Physics 2021 in partnership with Bangladesh Physical Society (BPS) and University of Dhaka during Feb 5-7, 2021. We founded the Frontiers of Physics (FOP) in 2019 with the goal to establish a collaborative program between the US and Bangladeshi Scientists for advancing science and education in Bangladesh in partnership with the Department of Physics of University of Dhaka and Bangladesh Physical Society. Objectives of FOP are: i) Exposure of physics research and education in Bangladesh and in the USA through conferences, ii) Collaboration in research projects through training and exchange programs, iii) Guidance with information to students for Ph.D. admission in US universities, iv) Possible introduction of student scholarships in Physics.
We planned initiation of the program through a high prole conference of FOP which would include a Nobel laureate Dr. Eric Cornell. However due to COVID-19 pandemic, the conference has been made virtual and shorted to 4-hours a day. We expect for a full-edge in-person conference in Dhaka in 2022.
We believe:

- Knowledge is a necessity for life and was made incumbent on both men and women by Prophet Muhammad. Without knowledge we are powerless. Physics which explains the underlying science in our everyday life is also called the "Queen" of science. Its wide applications range from medical treatment to climate change to space explorations and many others.
- The more we know the universe, the nature, the human functions, living beings, the more beauty we see, the more power and control we achieve to solve problems, and make advances for humanity.
- In the field of knowledge there is no space for differences in cultures, personal feelings, opinions, believes. As we believe, Allah has created everyone and gives knowledge regardless of any difference.
- Be part of organizations, such as Bangladesh Physical Society, American Physical Society, for intellectual and professional growth.
- Create a CV of your educational involvements and revise it as you achieve more.
- It is our duty to reach out to others outside physics and explain what Physics is and help and welcome others to join us.

We as part of FOP aim to build strong and long-lasting partnership with Bangladesh Physical Society and University of Dhaka, and engage in activities in Physics research and education for
advances in humanity.

The Ohio State University
USA



National institute for Standards and
Technology, USA

U.S. Ambassador Earl R. Miller's Remarks

As-salaamu alaikum. Good evening depending where you are in the world.
Vice Chancellor Dr. Md. Akhtaruzzaman, Honorable Minister Dr. Dipu Moni,
Distinguished guests,
It is an honor to be with you for this International e-Conference on Physics.
Over the next three days, accomplished speakers from Bangladesh and the United States – including 2001 American Nobel Laureate Eric Cornell – will lead discussions we hope pave the way for future scientific collaborations between the United States and Bangladesh. Many thanks to Dhaka University, Bangladesh Physical Society, and Frontiers of Physics for organizing this conference, and all participants. I salute all of you – the brilliant, dedicated scientists, researchers, and innovators leading the unending quest for greater scientific discovery in the 21st century and finding solutions to the world's most pressing challenges.

Today, we gather in celebration of scientific collaboration and in the virtual shadow of great collaborations right here in Dhaka. During its first hundred years, Dhaka University was part of some remarkable partnerships – including the work between Satyendra Nath Bose and Albert Einstein which continues to shape the way we understand physics and the world. Their research collaboration predicted something unique about atoms at temperatures nearing absolute zero. In fact, American Nobel Laureate Eric Cornell and his colleagues proved this theory, which led to creation of the world's first Bose-Einstein condensate in 1995, and the field of ultra-cold atoms.

As Bangladesh approaches the 50th anniversary of its independence, there's no better time to recognize the power of young minds to solve global challenges and shape the future of our increasingly interconnected world through scientific research. Honorable Minister Moni, I look forward to our two great nations working even closer in the next 50 years by increasing collaboration between U.S. and Bangladeshi educational institutions. The United States is committed to providing opportunities to prepare young people to become tomorrow's leaders. We are encouraging Bangladeshi girls to pursue careers in the STEM field; funding scholarships and exchange opportunities so talented Bangladeshi students and scholars can study and conduct research in the United States; supporting online learning and skill development for thousands of teachers with access to Massive Open Online Courses, or MOOCs, and other training programs. The United States is privileged and proud to invest in Bangladesh's future.

Last year, over 8800 Bangladeshi students studied in the United States, an all-time high for Bangladesh. Over 75% were pursuing degrees in the Science, Technology, Engineering, and Mathematics fields – many with partial or full funding. In fact, the Vice Chancellor is a Boston University Fulbright alumnus. And the Honorable Minister of Education, Bangladesh's and South Asia's first woman Foreign Minister, earned a Master's Degree in Public Health from John Hopkins University and also studied at Harvard.

And as we prepare to celebrate the International Day of Women and Girls in Science on February 11, I want to emphasize the significant contributions Bangladeshi women are making in advancing scientific research and discovery. Last year, 29-year-old Dhaka-born astrophysicist Dr. Tonima Tasnim Ananna – a postdoctoral researcher at Dartmouth College – was selected by Science News, an award-winning American science magazine, as one of ten young scientists to watch for her work developing X-ray telescope technology to better understand black holes. Her story reminds me of the inspiring words of Mae Carol Jemison, American engineer, physician, and NASA astronaut who was the first Black woman to travel in space. I share her words as the United States celebrates Black History Month and honors the indispensable incalculable contributions of Black Americans to the journey and story of America. For our students and scholars, young and not so young, Jemison said, "Don't let anyone rob you of your imagination, your creativity, or your curiosity. It's your place in the world; it's your life. Go on and do all you can with it and make it the life you want to live."

The COVID-19 pandemic reminds us of how truly interdependent we are on this wonderous vulnerable planet we are so privileged to share and responsible to protect. Your advancement of the science and knowledge to do so makes you frontline heroes, too. I admire you, salute you and we are all in your debt.

Thank you. Onek dhonnobad.

যুক্তরাষ্ট্রের রাষ্ট্রদূত আর্ল আর. মিলারের বক্তব্য

আস-সালামু আলাইকুম। সকলকে শুভ সন্ধ্যা, আপনারা বিশ্বের যে যেখানে আছেন।
উপাচার্য ড. মোঃ আখতারুজ্জামান, মাননীয় মন্ত্রী ডাঃ দিপু মনি,
সম্মানিত অতিথিবৃন্দ,
পদার্থবিজ্ঞানের এই আন্তর্জাতিক ই-সম্মেলনে আপনাদের সাথে থাকতে পেরে আমি নিজেকে সম্মানিত বোধ করছি।

আগামী তিন দিন ধরে অনুষ্ঠিত এই সম্মেলনে ২০০১ সালে আমেরিকান নোবেল বিজয়ী এরিক কর্নেল-সহ বাংলাদেশ ও যুক্তরাষ্ট্রের স্বনামধন্য বক্তারা আলোচনার নেতৃত্ব দেবেন, যার মাধ্যমে আমরা আশা করি যুক্তরাষ্ট্র এবং বাংলাদেশের মধ্যে ভবিষ্যতে বিজ্ঞানসংক্রান্ত সহযোগিতার পথ সুগম হবে। এই সম্মেলন আয়োজনের জন্য ঢাকা বিশ্ববিদ্যালয়, বাংলাদেশ ফিজিকাল সোসাইটি ও ফ্রন্টিয়ার্স অফ ফিজিক্স-কে এবং সকল অংশগ্রহণকারীকে ধন্যবাদ জানাই। আমি আপনাদের সকলকে অভিবাদন জানাই — মেধাবী নিবেদিতপ্রাণ বিজ্ঞানী, গবেষক, এবং উদ্ভাবক — যারা একুশ শতকে বৈজ্ঞানিক আবিষ্কার ও বিশ্বের সবচেয়ে দরকারি চ্যালেঞ্জগুলোর সমাধান খুঁজে পেতে অনিঃশেষ অনুসন্ধানে নেতৃত্ব দিচ্ছেন।

আজ, আমরা ঠিক এখানে, ঢাকায়, বিজ্ঞানসংক্রান্ত সহযোগিতা ও আমাদের মধ্যেকার গুরুত্বপূর্ণ অংশীদারিত্ব উদযাপনের জন্য (অনলাইনের মাধ্যমে) ভার্চুয়ালি একত্রিত হয়েছি। ঢাকা বিশ্ববিদ্যালয় এর প্রথম শত বছরে পদার্থবিজ্ঞান ও বিশ্বকে বোঝার ক্ষেত্রে আমাদের ধারণা তৈরিতে অব্যাহতভাবে অবদান রেখে চলা সত্যেন্দ্রনাথ বসু ও আলবার্ট আইনস্টাইনের মধ্যেকার অংশীদারিত্বমূলক কাজসহ কয়েকটি উল্লেখযোগ্য কাজে অংশীদার হয়েছে। তাদের (বোস-আইনস্টাইন) যৌথ গবেষণা পরম শূণ্যের কাছাকাছি তাপমাত্রায় পরমাণু সম্পর্কে অনন্য কিছু ধারণা তৈরি করেছে। সত্যি বলতে কী, আমেরিকান নোবেল বিজয়ী এরিক কর্নেল ও তার সহকর্মীরা এই তত্ত্বটি প্রমাণ করেছেন, যার ফলে ১৯৯৫ সালে বিশ্বের প্রথম বোস-আইনস্টাইন কনডেন্সেট এবং অতি-শীতল পরমাণু ক্ষেত্র তৈরি করা সম্ভব হয়েছে।

বাংলাদেশ যখন স্বাধীনতার ৫০তম বার্ষিকী উদযাপন করতে যাচ্ছে, সেই সময়ে বিজ্ঞান গবেষণার মাধ্যমে বৈশ্বিক চ্যালেঞ্জগুলো সমাধান করতে ও ক্রমবর্ধমানভাবে আন্তঃসংযুক্ত বিশ্বের ভবিষ্যত রূপদানে তরুণ মনের শক্তিকে স্বীকৃতি দেয়ার (ও কাজে লাগানোর) এরচেয়ে ভালো সময় আর হতে পারে না। মাননীয় মন্ত্রী মনি, আমার আশা করছি যুক্তরাষ্ট্র ও বাংলাদেশী শিক্ষা প্রতিষ্ঠানগুলোর আগামী ৫০ বছরে নিজেদের মধ্যে সহযোগিতা বৃদ্ধির মাধ্যমে আরো ঘনিষ্ঠভাবে কাজ করবে। মার্কিন যুক্তরাষ্ট্র তরুণ বয়সীদের আগামীর নেতা হিসেবে গড়ে উঠার প্রয়োজনীয় সুযোগ সুবিধার ব্যবস্থা করতে প্রতিশ্রুতিবদ্ধ। আমরা বাংলাদেশী মেয়েদের স্টেম (STEM-বিজ্ঞান, প্রযুক্তি, প্রকৌশল ও গণিত) ক্ষেত্রে পেশা গড়ে তুলতে উত্সাহিত করছি; বৃত্তির জন্য তহবিল দিচ্ছি ও (শিক্ষা) বিনিময় কর্মসূচির মাধ্যমে মেধাবী বাংলাদেশী শিক্ষার্থী ও পন্ডিত (শিক্ষাবিদ)-দের যুক্তরাষ্ট্রে অধ্যয়ন ও গবেষণা করার সুযোগ করে দিচ্ছি; ম্যাসিভ ওপেন অনলাইন কোর্স ও অন্যান্য প্রশিক্ষণ কর্মসূচির অধীনে সহস্রাধিক শিক্ষকের জন্য অনলাইনের মাধ্যমে শেখা ও দক্ষতা উন্নয়নে সহায়তা করছি। যুক্তরাষ্ট্র বাংলাদেশের ভবিষ্যতের জন্য বিনিয়োগ করতে পেরে সম্মানিত ও গর্বিত।

গত বছর ৮,৮০০ এরও বেশি বাংলাদেশী শিক্ষার্থী যুক্তরাষ্ট্রে অধ্যয়ন করেছে, যা বাংলাদেশী শিক্ষার্থীদের যুক্তরাষ্ট্রে অধ্যয়নের ক্ষেত্রে সর্বকালের মধ্যে সর্বাধিক। তাদের মধ্যে ৭৫% এরও বেশি বিজ্ঞান, প্রযুক্তি, প্রকৌশল ও গণিত বিষয়ে ডিগ্রি অর্জনের জন্য অধ্যয়ন করছে, এবং অনেকেই আংশিক কিংবা পূর্ণ বৃত্তি পাচ্ছে। সত্যি বলতে, উপাচার্য নিজেও সাবেক ফুলব্রাইট শিক্ষার্থী হিসেবে বোস্টন বিশ্ববিদ্যালয়ে পড়েছেন। এবং মাননীয় শিক্ষামন্ত্রী, বাংলাদেশ ও দক্ষিণ এশিয়ার প্রথম নারী পররাষ্ট্র মন্ত্রী, (আমেরিকার) জন হপকিন্স বিশ্ববিদ্যালয় থেকে জনস্বাস্থ্যে স্নাতকোত্তর ডিগ্রি অর্জন করেছেন, এবং হার্ভার্ডেও পড়েছেন।

এবং আগামী ১১ ফেব্রুয়ারি ইন্টারন্যাশনাল ডে অফ উইমেন অ্যান্ড গার্লস ইন সায়েন্স (বিজ্ঞান চর্চায় নারী ও কন্যাশিশু বিষয়ক আন্তর্জাতিক দিবস) উদযাপনে আমাদের প্রস্তুতির এই মুহূর্তে, আমি বিজ্ঞান গবেষণা ও আবিষ্কারে বাংলাদেশী নারীদের গুরুত্বপূর্ণ অবদানের কথা জোরালোভাবে উল্লেখ করতে চাই। গত বছর ডার্টমাউথ কলেজের একজন পোস্টডক্টরাল গবেষক বাংলাদেশী বংশোদ্ভূত ২৯ বছর বয়সী জ্যোতির্বিজ্ঞানী ড. তনিমা তাসনীম অনন্যা কৃষ্ণ গহ্বরকে আরো ভালোভাবে জানতে ও বুঝতে এক্সরে টেলিস্কোপ প্রযুক্তি তৈরির জন্য পুরস্কারজয়ী আমেরিকান বিজ্ঞান সাময়িকী *সায়েন্স নিউজ* এর বিশ্বের সেরা দশ তরুণ বিজ্ঞানীর তালিকায় স্থান করে নিয়েছেন। তার (ড. তাসনীম) গল্পটি আমাকে আমেরিকান প্রকৌশলী, চিকিত্সক ও নাসার নভোচারী মায়ে ক্যারল জেমিসনের অনুপ্রেরণামূলক বক্তব্যের কথা মনে করিয়ে দেয়, যিনি মহাকাশ ভ্রমণকারী প্রথম কৃষ্ণাঙ্গ নারী। আমেরিকার ব্ল্যাক হিস্ট্রি মান্থ উদযাপনের এই সময়ে আমি আমেরিকার এগিয়ে চলায় কৃষ্ণাঙ্গ আমেরিকানদের অপরিহার্য অসংখ্য অবদানের প্রতি সম্মান দেখিয়ে তার (জেমিসন) বলা সেই কথাগুলো আপনাদের সামনে তুলে ধরতে চাই। আমাদের শিক্ষার্থী ও পন্ডিত, তরুণ ও অল্প বয়সীদের উদ্দেশ্যে জেমিসন বলেছিলেন, "কাউকে তোমার কল্পনা, তোমার সৃজনশীলতা, কিংবা তোমার কৌতুহল কেড়ে নিতে দিও না। এটা পৃথিবীতে তোমার জায়গা, এটাই তোমার জীবন। এগিয়ে যাও এবং এটি দিয়ে যা কিছু পারো করো এবং তোমার চাওয়ার মতো করে জীবন গড়ে তোল।"

কোভিড-১৯ মহামারি আমাদেরকে বিস্ময়করভাবে ঝুঁকিতে থাকা এই পৃথিবীতে আমরা কতোটা পরস্পরের উপর নির্ভরশীল সেকথা স্মরণ করিয়ে দিয়েছে, যেখানে আমরা নিজেদের মধ্যে সুবিধাগুলো ভাগ করে নিতে পারছি এবং সুরক্ষার জন্য দায়বদ্ধ। এই কাজে জ্ঞান ও বিজ্ঞানে আপনাদের অগ্রগতিমূলক কাজ আপনাদেরকে সম্মুখসারির নায়কও করে তুলেছে। আমি আপনাদের শ্রদ্ধা ও অভিবাদন জানাচ্ছি এবং আমরা সবাই আপনাদের কাছে ঋণী।

থ্যাংক ইউ। অনেক ধন্যবাদ।

Message from Secretary of the Organizing Committee

On behalf of the Organizing Committee, I have the honor and pleasure to welcome all of you in the International e-Conference on Physics jointly organized by Bangladesh Physical Society, University of Dhaka and Frontiers of Physics (USA) to be held on 5-7 February 2021.

Bangladesh Physical Society is an association of scientists, engineers and professionals working in the field of Physical Sciences. The theme of the conference is focused on the research, development, and educational collaboration of US-Bangladesh, which would be helpful for implementing our vision 2041 for a socio-economically developed digital Bangladesh.

Dhaka University and Frontiers of Physics of US have extended their hand of cooperation. Sincere gratitude and thanks to everyone. It would not have been possible to organize today's conference without your cooperation, advice and motivation. We are sincerely grateful to the teachers, students, researchers and all the participants from various universities and research institutes. They are the centerpiece of this conference.

The Honorable Chief Guest of Inaugural Ceremony of International e-Conference of Physics 2021 organized by Bangladesh Physical Society is Dr. Dipu Moni, Hon'ble Minister, Ministry of Education, Government of the People's Republic of Bangladesh. Despite many engagements, the Hon'ble Education Minister has given her precious time today to encourage all of us, to which we are very grateful. We believe that his efforts will open new avenues in higher education and research in physics in Bangladesh.

The presence of our Guests of Honor in the Inaugural ceremony Prof. Md. Akhtaruzzaman, Vice-Chancellor, University of Dhaka, Bangladesh and Earl R. Miller, U.S. Ambassador to the People's Republic of Bangladesh has made the program festive.

The special guests of our Conference are Dr. Charles W. Clark, Fellow, National Institute of Standards and Technology, USA and Prof. Sultana N. Nahar, APS Fellow, Department of Astronomy, The Ohio State University, USA. Their presence has made our event ornamental. The confidence and passion for their work and knowledge will undoubtedly encourage researchers to innovate.

The invited talks in each technical session on the current developments will be delivered by the distinguished academician and scientists from the different corners of the world. Researchers from all corners of the world are heartily expected to participate in the Conference.

Thanks, extended to the members of organizing committee, technical committee, advisory committee and other committee members for their outstanding contribution to organize the three days long international conference. Appreciation also goes to the sponsored partners for their enormous support. Special thanks to honorable Chief Guest and Special guest for their kind attendance on the program to make it successful one.

Dr. Mohammed Nazrul Islam Khan
Secretary, Organizing Committee
International e-Conference on Physics -2021

International e-Conference on Physics -2021

Date: 5 – 7 February 2021 (Friday to Sunday)
Time: 19:00 to 23:00 (Bangladesh Standard Time, BST)
Venue: Zoom Online Platform

Conference Programme

Day 1 **Friday, 5th February 2021, 19:00 – 23:00 BST**	
Session I: Inauguration, 1900 – 20:10 **Venue (Virtual):** Zoom Link:	
1900-1910	Welcome Address: **Prof. Mesbahuddin Ahmed**, *President, Bangladesh Physical Society*
1910-1935	Address by the Special Guests: **Dr. Charles W. Clark**, NIST Fellow, *National Institute of Standards and Technology, USA* **Prof. Sultana N. Nahar**, APS Fellow, *Department of Astronomy, The Ohio State University, USA*
1935-1955	Address by the Guests of Honor: **Prof. Md. Akhtaruzzaman**, *Vice-Chancellor, University of Dhaka, Bangladesh* **His Excellency Earl R. Miller**, *U.S. Ambassador to the People's Republic of Bangladesh*
1955-2005	Address by the Chief Guest: **Dr. Dipu Moni**, MP, *Honorable Minister, Ministry of Education, People's Republic of Bangladesh*
2005-2010	Vote of Thanks: **Dr. Md. Nazrul Islam Khan**, *BPS Secretary, Bangladesh Atomic Energy Commission*
Session II: Plenary Lectures **Venue (Virtual):** Zoom Link: **Session Chair:** Prof. Mesbahuddin Ahmed, *President, Bangladesh Physical Society* **Session Co-Chair:** Dr. A. K. M. Abdul Hakim, *Department of Glass & Ceramic Engineering, BUET*	
2015-2100	**Prof. M. Zahid Hasan**, *Eugene Higgins Professor of Physics, Princeton University, USA* Title: Topological Quantum Matter
2100-2145	**Prof. Khandker A. Muttalib,** APS Fellow, *Department of Physics, University of Florida, USA* Title: Progress in thermoelectricity: Green energy for future?
2145-2300	**Prof. Eric A. Cornell,** *Nobel Laureate in Physics 2001, JILA, University of Colorado, USA* Title: A Century of Bose Statistics, Including a Quarter-Century of Bose-Einstein Condensation
Day 2 **Saturday, 6th February 2021, 19:00 – 23:00 BST**	
Session III: Plenary Lectures (each lecture: 25 min, presentation & 5 min, Q&A) **Venue (Virtual):** Zoom Link: **Session Chair:** Prof. A. B. M. Obaidul Islam, *Chairman, Department of Physics, University of Dhaka* **Session Co-Chair:** Prof. Suranjan Kumar Das, *Department of Physics, Jagannath University*	
1900-1930	**Dr. Syed Mohammod Hossain,** *Planning & Development, Bangladesh Atomic Energy Commission* Title: The Role of BAEC for the Development of Nuclear Infrastructure and related Workforce in Bangladesh
1930-2000	**Prof. Anil K. Pradhan,** APS Fellow, *Department of Astronomy, The Ohio State University, USA* Title: Spectroscopic modeling of stellar-exoplanetary systems

2000-2030	**Prof. G. M. Bhuiyan,** AvH Fellow**,** *Department of Theoretical Physics, University of Dhaka, Bangladesh* Title: Segregation and Critical Behavior of Liquid Binary Alloys
2030-2115	**Dr. Charles W. Clark,** NIST Fellow**,** *National Institute of Standards and Technology, USA* Title: The Quantum Neutron
2115-2145	**Prof. K Siddique-e-Rabbani,** *Department of Biomedical Physics & Technology, University of Dhaka* Title: Focused Impedance Method (FIM), an innovation of Dhaka University with potential applications in Biomedical Physics and beyond
2145-2230	**Prof. Sultana N. Nahar,** APS Fellow*, Department of Astronomy, The Ohio State University, USA* Title: Gravitational waves, merger of neutron stars, black holes, and heavy elements
2230-2300	**Prof. Mohammad Idrish Miah**, *Department of Physics, CU, Honorary Prof., Griffith University* Title: Multiphoton spin generation and detection in semiconductors: Theory and experiment
Day 3 **Sunday, 7th February 2021, 19:00 – 23:00 BST**	
Session VI: Plenary Lectures (each lecture: 25 min, presentation & 5 min, Q&A) **Venue (Virtual): Zoom Link:** **Session Chair: Prof. Sultana N. Nahar,** APS Fellow**,** *Department of Astronomy, The Ohio State University, USA* **Session Co-Chair:** Prof. Ishtiaque M. Syed, *Department of Physics, University of Dhaka*	
1900-1930	**Dr. A. K. M. Abdul Hakim,** BPS Fellow*, Department of Glass & Ceramic Engineering, BUET* Title: Size Dependent Properties of Nanostructured Materials
1930-2000	**Prof. Sheikh A. Akbar,** Electrochemical Society Fellow*, Dept. of MSE, The Ohio State University, USA* Title: Ceramic Nano-heterostructures by Materials Design: Platforms for Sensing and Biomedical Applications
2000-2030	**Prof. A. A. Mamun,** AvH Fellow**,** *Department of Physics, Jahangirnagar University, Bangladesh* Title: Nucleus-Acoustic Waves in Degenerate Quantum Plasmas
2030-2100	**Prof. Saleh Hasan Naqib,** BAS Fellow*, Department of Physics, University of Rajshahi, Bangladesh* Title: Pseudogap in hole doped cuprates: Role of the other gap in copper oxide high-Tc superconductors
Session V: US-Bangladesh Education Collaboration Programme	
2100-2230	**Mr. Muhammed Sohel Iqbal**, Director, *EducationUSA Public Affairs Section, U.S. Embassy, Dhaka* *Title: Study in the US: Guidelines and Scopes* **Dr. Charles W. Clark,** NIST Fellow*, National Institute of Standards and Technology, USA* Title: US and Bangladesh collaboration **Prof. Sultana N. Nahar,** APS Fellow*, Department of Astronomy, The Ohio State University, USA* Title: Tips for admission in US universities
Valedictorian Session **Venue (Virtual): Zoom Link:**	
2230-2300	Chair: **Prof. Mesbahuddin Ahmed,** *Convener, Organizing Committee* Vote of Thanks: **Dr. Mohammed Nazrul Islam Khan,** *Secretary, Organizing Committee*

Topological Quantum Matter

M. Zahid Hasan
Princeton University, USA
Email: mzhasan@Princeton.EDU

Abstract

Electrons organize in ways to give rise to distinct phases of matter such as insulators, metals, magnets or superfluid or superconductors (Bose condensates). In the last ten years or so, it has become increasingly clear that in addition to the symmetry-based classification of matter, topological consideration of wavefunctions plays a key role in determining distinct or new quantum phases of matter [see, for an introduction, Hasan & Kane, Reviews of Modern Physics 82, 3045 (2010)]. In this talk, I briefly introduce these new topological concepts in the context of their experimental realizations in quantum matter. As examples, I present how tuning a topological insulator whose surface hosts an unpaired Dirac fermion can give rise to topological (Bose condensate) superconductors with helical Cooper pairing leading to novel Majorana (particles that are their own antiparticles) platforms, Weyl fermion (massless charged fermions unlike photons) semimetals with "fractional" Fermi surfaces, and strongly correlated magnetic or superconducting states of matter. These "topological quantum matter" harbor novel and unprecedented properties that may lead to the development of next generation quantum technologies, fault-tolerant qubit-based quantum computers in the longer run.

Progress in thermoelectricity: Green energy for future?

K.A. Muttalib
University of Florida, USA
Email: muttalib@phys.ufl.edu

Abstract

About 75% of energy generated by a car-engine is lost as waste heat. A thermoelectric device can generate electricity from a temperature difference, and therefore can convert part of the waste heat back to usable electricity. In principle, thermoelectricity can be a simple source of abundant green energy. However, currently available devices are very inefficient, and therefore not cost-effective. In this talk I will discuss some novel ideas to increase the efficiency as well as the power output that can make thermoelectric devices industrially competitive.

A Century of Bose Statistics and a Quarter-Century of Bose-Einstein Condensation

Eric Cornell
JILA, University of Colorado, USA
Email: cornell@jila.colorado.edu

Abstract

As a gas becomes colder and colder, one will find it increasingly difficult to distinguish any one gas atom from its neighbor. A century ago, Bose realized that this property of "indistinguishability" could have profound physical consequences. Einstein further predicted that at temperatures close to absolute zero, a very strange thing can happen to a gas. This "very strange thing", called Bose-Einstein condensation, was finally observed in a lab some 75 years later in 1995. In the 25 years since then, Bose-Einstein condensation has been the subject of many intriguing experiments.

The Role of BAEC for the Development of Nuclear Infrastructure and related Workforce in Bangladesh

Syed Mohammod Hossain
Planning & Development Division, Bangladesh Atomic Energy Commission, E-12/A, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh
Email: syed9495@yahoo.com

Abstract

Bangladesh Atomic Energy Commission (BAEC) is the competent authority to deal with nuclear science, technology, and applications. Being firmly committed to achieve sustainable development goals (SDGs) through the peaceful uses of Atomic Energy, BAEC conducts various programs in the thematic sectors of Physical Sciences, Biological Sciences, Nuclear Engineering, Medical Applications and Nuclear Power, etc. In these sectors BAEC has developed a pool of research infrastructure and human capital through years of cumulative efforts. The achievement of self-reliance and sustainability of these programs relies heavily on a specialized and highly trained workforce. BAEC considers the following components for human resource development and management: education and outreach, training, nuclear knowledge management with sharing, networking, and public acceptance. In case of education, the strategy of BAEC is to develop nuclear aware people, nuclearize people and nuclear people. Various programs/initiatives have already been taken to develop these three categories of people. For capacity building of nuclear professionals, various training programs have been initiated in cooperation with national and international strategic partners. The presentation focuses on the contribution of BAEC for the development of nuclear infrastructure and related workforce in the country as well as how it provides the useful window to other organizations/institutions to use these national facilities and expertise.

Spectroscopic modeling of stellar-exoplanetary systems

Anil K Pradhan
Department of Astronomy, The Ohio State University, USA
Email: pradhan.1@osu.edu

Abstract

Cool Sun-type stellar types are expected to host extra-solar planets. Following detection of large numbers of exoplanets by space-based observatories, the next major step in space-based astrophysics is detailed spectral analysis and modeling of star-planet systems. That would be one of the primary objectives of the upcoming James Webb Space Telescope (JWST), with wavelength range in the optical to mid-IR from 0.6-28 microns. Therein lie several strong lines of atomic ions of elements, including biosignatures of DNA-based lifeforms, such as C, N, O, P and S, and heavy metallic lines of Ti, Fe, etc. from "hot jupiters". We are carrying out atomic calculations using the powerful and accurate Breit-Pauli R-Matrix method for all physical processes responsible for spectral formation: photoionization, electron impact excitation and recombination, transition probabilities, and continuum UV opacities needed to accurately determine host-star radiation fields. Monte Carlo spectral simulations of exoplanetary atmospheres irradiated by cool star radiation fields are planned to use the general-purpose code. GEANT4, with new and existing atomic/molecular data. We plan to focus on phosphorus, a binding element of DNA, and possible detection in planetary atmospheres.

Segregation and Critical Behaviour of Liquid Binary Alloys

G. M. Bhuiyan
Department of Theoretical Physics, University of Dhaka
E-mail: gbhuiyan@du.ac.bd

Abstract

Recently, the microscopic description in the study of segregating properties and relevant critical behaviour of liquid metallic binary alloys has gained renewed scientific and technological interests. Especially, in understanding the basic mechanisms, from the point of interionic interaction, and how and why segregation in some metallic alloys takes place at and under certain thermodynamic state specified by temperature and pressure. Here the calculations for these properties are performed by combining electronic theory of metal, statistical mechanics and the perturbative approach. The necessary reference system in the perturbation theory is described by the hard sphere liquids that is well tested for simple liquid metals and their alloys. The static effects such as the energy of mixing, enthalpy of mixing and entropy of mixing describe the magnitudes of the critical concentration and critical temperature well but the critical exponents follow mean field theory. On the other hand the atomic transport properties, in particular, the shear viscosity shows a power law behaviour near critical point of segregation with a critical exponent of 1.08 which apparently indicates that the phase separation due to segregation belongs to a different universality class.

The Quantum Neutron

Charles W. Clark

Joint Quantum Institute, National Institute of Standards and Technology (NIST) and the University of Maryland, USA

Email: *charles.winthrop.clark@gmail.com*

Abstract

The neutron is the only electrically-neutral isotope among the ~4,000 members of the Table of the Nuclides. Neutrons thus have a unique ability to travel easily through matter, even at the lowest kinetic energies at which they have been produced (a few hundred nanoelectronvolts). This enables a number of useful applications, such as imaging structures within dense materials, and fundamental scientific capabilities like tests of quantum entanglement, coherence restoration in quantum information, and matter-wave optics. Breakthroughs in both fundmental and applied neutron science were made by my friend and colleague, Muhammad Arif (Madaripur, Bangladesh, January 24, 1954 - Frederick, Maryland, USA, November 27, 2018) during his 30-year career at the National Institute of Standards and Technology (NIST). I will report on recent developments in neutron interferometry, imaging and detection.

Focused Impedance Method (FIM), an innovation of Dhaka University with potential applications in Biomedical Physics and beyond

K Siddique-e-Rabbani

Department of Biomedical Physics & Technology, University of Dhaka

Abstract

That a relationship exists between electricity and the animal body has been known since the famous experiment of Galvani in 1791. Subsequently it has been discovered that all living cells have electrical properties and that this may be utilized for different investigations of the human body, which is essentially a volume conductor. In attaching electrodes to the human body, contact potentials develop which tend to mask bulk impedance. To eliminate this contact impedance, a four-electrode or tetra-polar impedance measurement (TPIM) system was used in which an alternating current is passed through two electrodes and the potential developed across the other two is measured giving a 'transfer impedance'. However, current lines inside a human body bend around objects with different conductivities, which limited the application of TPIM severely. A significant breakthrough occurred through the innovation of Electrical Impedance Tomography (EIT) in 1980s by a group in the UK and its later developments in which many electrodes are used to obtain 2D or 3D impedance images of a volume conductor. However, it is difficult to maintain good contacts for all electrodes, and the analyses are very complex. Therefore, EIT has not yet made any significant impact in any real life application. Here, a very important 'bridge innovation' came from

the present author from the University of Dhaka, which he named 'Focused Impedance Method (FIM)' in 1994. FIM can localize a target region within the body using only 8, 6 or 4 electrodes respectively. His team at Dhaka has shown viable applications of FIM in the study of stomach, lungs, and any small region through suitable placement of electrodes. The team also developed an extension of this method which the author named 'Pigeon Hole Imaging (PHI)'. They also showed potential of FIM or PHI in breast tumour characterization, to determine whether the tumour is malignant or not, using measurements at different frequencies, and also developed a technique to measure transcutaneous fat thickness. The development work is continuing and the team has already published many papers and have written two book chapters on FIM through invitation. Recently, several groups in the advanced countries of the world have taken up FIM to develop techniques for detecting glaucoma of eye, to detect arteries and veins, to measure bladder emptying, etc. Being a very low cost and simple method, it has the promise of bringing low cost medical devices for different investigations to the affordability of low and medium income countries. FIM may also have important application in geology, oceanography, and various other disciplines.

Gravitational waves, merger of neutron stars, black holes, and heavy elements

Sultana N. Nahar

Department of Astronomy, The Ohio State University, Ohio, USA

Email: nahar.1@osu.edu

Abstract

With the recent detection of gravitational waves, a new door has opened to the knowledge of our understanding of objects and processes in the universe, such as, gravitational waves we read about but never saw its existence, merger of black holes and neutron stars that we were not aware of, heavy elements that we study but did not have a complete picture of their formation. The scope has been recognized by two Nobel prizes in Physics, in 2017 and in 2020. I will discuss their background and the underlying science of spectroscopy of photo-excitations that can interpret the observed spectrum of the lanthanide heavy elements observed following the gravitational waves and predict what spectral features to expect for understanding these cosmic events.

Multiphoton spin generation and detection in semiconductors: Theory and experiment

M. Idrish Miah

Department of Physics, University of Chittagong, Chittagong 4331, Bangladesh.
Queensland Micro- and Nanotechnology Centre, Griffith University, Nathan, QLD 4111, Australia.
E-mail: m.miah@griffith.edu.au; m.idrish.miah@cu.ac.bd

Abstract

High spin-polarizations are required for the efficient detection of spin currents in spintronic devices. A pump–probe multiphoton spin-polarization spectroscopic study is carried out in zinc-blende semiconductor GaAs. In the semiconductor samples, a spin-polarized carrier population is produced by the absorption of a monochromatic circularly polarized light beam with two-photon energy above the direct band gap. The production of a carrier population with a net spin is a consequence of the optical selection rules for the heavy-hole and light-hole valence-to-conduction band transitions. This production is probed by the spin-dependent transmission of the samples in the time domain. The spin polarization of the conduction-band-electrons in dependences of delay of the probe beam, doping density, temperature, power as well as of pumping photon energy is estimated. The spin polarization is found to depolarize rapidly for pumping energy larger than the energy gap of the split-off band to the conduction band. From the polarization decays, the spin relaxation times are also estimated. Compared to one-photon pumping, the results, however, show that an enhancement of the spin-polarization is achieved by multiphoton excitation of the samples. The experimental results are compared with those obtained in calculations using second order perturbation theory of the spin transport model. A good agreement between experimental and theoretical results is obtained. The results are discussed within the scope of the dominant spin relaxation mechanism.

Size Dependent Properties of Nanostructured Materials

M A Hakim

Department of Glass and Ceramic Engineering, BUET, Dhaka-1000
E-mail: hakim.akm@gmail.com

Abstract

Over the past few decades, research on nanomaterials has become the center of interest to physicists, chemists, materials scientists, engineers, architects and who else not. Nanoscale materials with dimensions less than 100 nm have become promising materials for multifaceted applications around energy, environmental remediation, electronics and bio-medical due to their tailored properties based on physical size, shape, and distribution density. Large surface area and quantum size effects result in completely new properties of nanostructured materials. Grain size has tremendous effects on the properties of materials. When the grain sizes are comparable or less than the critical length scale of the physical phenomena, the conventional size laws break-down and may even be reversed displaying

unusual results for example insulators becomes conductors, the opaque substance becomes transparent, inert materials become catalytic, magnetic materials become nonmagnetic and so on. The ultimate objective of using nanomaterial is the miniaturization of devices with maximizing efficiency and minimizing the use of resources. Nanostructured materials have been in practical use since ancient time without understanding their scientific essence. Nature is the most powerful source and inspiration for understanding the role of nanostructured materials in real life. Nature has developed materials, objects, and processes in the macro to nanoscale that have been perfected through the process of evolution over millions of years such as lotus leaf, spider silk, nacre, bones, honeycomb structure of beehive etc. The biological cell of living things, the cell membrane and many functional organs are in fact of nanometer size. Spiders are one of biology's best manufacturing engineers with an incredibly effective material fabrication capability making the strongest natural fiber consisting of many fibrils with a diameter of 7 nm. Substantial research works have been carried out in Bangladesh and continuing with nanostructured ultra-soft amorphous metallic ribbons of Fe-Si-B with the addition of Cu and Nb. Magnetic permeability has been enhanced by two orders of magnitude as the grain size of the magnetic phase α-Fe (Si) could be controlled within the length of the domain wall width of 35 nm by thermal treatment of the amorphous ribbons. Extensive work on nonmaterial synthesis, characterization, and detail study of multiferroic, magnetic, photocatalytic, and antibacterial activity of synthesized nanomaterials are being carried out in Bangladesh. $BiFeO_3$ is a promising material displaying magnetic and strong ferroelectric properties at room temperature. Due to this novel property, it has possible applications in spintronics, memory devices and sensors. But its low magnetic moment and high leakage current restrict its device application. A significant improvement in magnetization and leakage current have been achieved by reducing the particle size below the critical length scale of one spin cycloid. Through this lecture some experimental results of ongoing research in nanomaterials in GCE-BUET and Materials Science Division, Atomic Energy Centre Dhaka will be highlighted.

Ceramic Nano-heterostructures by Materials Design: Platforms for Sensing and Biomedical Applications

Sheikh A. Akbar

NSF Center for Industrial Sensors and Measurements (CISM)
Department of Materials Science and Engineering
The Ohio State University (OSU), Columbus, OH 43210, USA
Email: akbar.1@osu.edu

Abstract

This talk summarizes R&D efforts in the author's laboratory on the fabrication of oxide nano-heterostructures, exploiting intrinsic material properties, that are highly scalable and do not require use of lithography. One such process creates crystallographically oriented nanofiber arrays of single crystal TiO_2 in H_2/N_2 environment. H_2/N_2 heat treatment was also used to grow nanofibers on polycrystalline SnO_2, showing directional growth on grains with crystal facets. We have also

developed a process to create nanofibers of TiO_2 on Ti metal/alloys via oxidation under a limited supply of oxygen. We have succeeded in converting the 1-D TiO_2 nanofiber grown by thermal oxidation to nano-dendritic titanates by hydrothermal treatment. In another process, SnO_2 nanowires grown from commercial FTO slides using the vapor-liquid-solid (VLS) method were placed in a microwave-assisted hydrothermal chamber where TiO_2 nanorods nucleated radially from the SnO_2 nanowire cores. We developed yet another interesting nanostructure (nanoislands and/or nanobars) during thermal annealing of an oxide (GDC) on top of another oxide (YSZ) substrate that self-assembles along the softest elastic direction of the substrate. What is common about these structures is that they are fabricated without the use of lithographic techniques and involves simple processes such as gas-phase reactions and stress-driven processes. These nanostructures can be used as platforms for chemical sensing, catalysis, photocatalysis, photovoltaics and biomedical applications. Preliminary results of some of these applications are presented including an Open access Database of Resistive type gas Sensors (ODORS) that is under development.

Nuclear-Acoustic Waves in Degenerate Quantum Plasma

A A Mamun

Department of Physics, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh

Abstract

The degenerate pressure driven nucleus-acoustic (NA) waves propagating in a cold degenerate quantum plasma system [containing cold inertia less degenerate electron species (DES), cold inertial non-degenerate light nucleus species (LNS), and stationary heavy nucleus species (HNS)] is identified for the first time by Mamun [Phys. Plasmas **25**, 024502 (2018)]. The NA waves (in which the mass density of the cold LNS provides the inertia, and the degenerate pressure of cold inertia less DES gives rise to the restoring force) are new since they completely disappear if the degenerate pressure of the cold DES is neglected. It is completely different from the well-known ion-acoustic (IA) waves on an important point that for an absolutely cold plasma limit the NA waves do exist, but the IA waves do not exist anyway. It is found that the HNS is not essential for the existence of the NA waves. However, the phase speed of this new NA waves decreases with the rise of the charge number density of the stationary HNS for both non-relativistically and ultra-relativistically DES. The linear dispersion properties of the new NA waves have been pinpointed. The NA waves and their dispersion properties are expected to be useful in understanding the basic features of the electrostatic perturbation mode in space and laboratory degenerate quantum plasma systems.

Pseudogap in hole doped cuprates: role of the other gap in copper oxide high-T_c superconductors

S. H. Naqib

Department of Physics, University of Rajshahi, Rajshahi 6205, Bangladesh
Email: salehnaqib@yahoo.com

Abstract

The overriding question that remains unanswered after over three decades of discovery of superconductivity in hole doped high-T_c cuprates is what are the nature of the underlying electronic correlations that control the strange and rich in diversity temperature-hole content (*T-p*) phase diagram? Besides superconductivity at high temperature itself, the pseudogap in the low energy quasiparticle spectral density dominates the *T-p* phase diagram to a very large extent of cuprate superconductors. Therefore, unlocking the mystery of *T-p* phase diagram depends largely on the understanding of the pseudogap correlations. Origin of this momentum dependent normal state gap and its evolution with number of doped holes in the CuO_2 plane are still unresolved and remain a hotly debated issue. The pseudogap affects almost all the normal and superconducting state properties to varying degrees. We shade light on the variations of a number of normal and superconducting state properties of copper oxide superconductors with the hole content dependent pseudogap energy scale in this presentation.

U.S. Scholarship and Exchange Opportunities

The U.S. Department of State sponsors a wide range of exchange programs for individuals, from high school students to doctoral students to mid-career professionals! Each program has a different application process and timeline. U.S. Embassy Dhaka invites you to apply for the program that fits your aspirations and eligibility.

For High School Students, Grades 8-11

- **The Kennedy-Lugar Youth Exchange and Study Program (YES)** provides scholarships for high school students (15-17 years) to spend one academic year in the United States. Students live with American families, attend a U.S. school, and build leadership skills. Typical application period – October through November every year. Visit: **http://iearnbd.org.**

For Undergraduate Students

- **The Community College Initiatives Program (CCIP)** is an intensive academic program that provides emerging Bangladeshi student leaders with one academic year of non-degree study at an American community college in order to develop a deeper understanding of the United States while simultaneously enhancing their professional skills. Typical application period – October through November every year. Visit: **https://nvcc.edu/ccip**

- **The Global Undergraduate Semester Exchange Program (UGRAD)** offers undergraduate Bangladeshi students the opportunity to spend a semester studying at a U.S. university or community college. Typical application period – November through December every year.
  Visit: **https://exchanges.state.gov/non-us/program/global-undergraduate-exchange-program-global-ugrad.**

For Individuals Interested in Graduate-Level Study

- **The Fulbright Foreign Student Program** funds graduate study for Master's degrees in the United States for one year or longer. Typical application period – February through June every year.
  Visit: **https://foreign.fulbrightonline.org/about/foreign-fulbright.**

For Students Interested in SPACE and STEM Fields

- To learn about **NASA opportunities for students**, visit: **https://www.nasa.gov/stem/artemis.html**. Please review opportunities carefully. Each opportunity outlines eligibility criteria, including if program is open to international students.

For Educators

- The **Fulbright Teaching Excellence and Achievement (TEA) Program** and the **Fulbright Distinguished Award in Teaching for International Teachers (DAI)** bring public-sector secondary school teachers to the United States for a six-week (TEA) or five-month (DAI) professional development program, including language proficiency, coursework on teaching methodology, technology training, and practical experiences in U.S. schools. Typical application period – February through March every year.
  Visit: **https://exchanges.state.gov/non-us/program/fulbright-teaching-excellence-and-achievement-program; https://exchanges.state.gov/us/program/fulbright-distinguished-awards-teaching-us-teachers**

- The **Fulbright Foreign Language Teaching Assistant (FLTA)** program sends young teachers of English as a Foreign Language to a U.S. institution on a nine-month program to teach Bangla-language classes to American students. Through this program the FLTAs and their students get a unique opportunity to learn about each other's cultures to build mutual understanding between the United States and Bangladesh. Typical application period – March through July every year. Visit: **https://foreign.fulbrightonline.org/about/fulbright-flta**.

- The **Study of the U.S. Institute (SUSI) Scholar Programs** are post-graduate level academic programs of five to six weeks for mid-career foreign scholars, faculty, practitioners, and secondary educators whose responsibilities involve strengthening curricula and improving teaching about the United States in academic institutions abroad. Typical application period – November through December every year.
  Visit: **https://exchanges.state.gov/non-us/program/study-us-institutes-scholars**.

For Professionals

- **The Hubert H. Humphrey Fellowship Program** brings mid-career professionals to the United States for a year of non-degree, graduate-level study, and professional collaboration with U.S. counterparts. Typical application period – May through July every year. Visit: **https://humphreyfellowship.org**.

- The **Fulbright Visiting Scholar Program** provides opportunities for experienced professionals, university faculty members, and researchers at think-tanks and relevant governmental and non-governmental organizations to conduct advanced research and university lectureship in the United States. Typical application period – September through November every year. Visit: **https:/cies.org/program/fulbright-visiting-scholar-program**.

- **Community Solutions Program** seeks motivated up and coming Bangladeshi community leaders to participate in a four-month fellowship with a U.S. nonprofit organization or local government agency; program includes an integrated leadership curriculum and individualized coaching. Fellows return home to apply their new skills through a community action project. Typical application period – Mid-September through October every year.
  Visit: **https://irex.org/project/community-solutions**.

- **International Writing Program (IWP)** brings together emerging literary figures from around the world for an 11-week writer-in-residency program. The program enables participants to present their countries' literatures to U.S. audiences and to learn more about U.S. society and culture. Participants also develop professional skills, become familiar with the U.S. publishing industry, and experience U.S. volunteerism and its central role in American society. Typical application period – April through July every year. Visit: **http://iwp.uiowa.edu**.

visit,

English: bd.usembassy.gov
Bengali: bd.usembassy.gov/bn

At a Glace

Eric A. Cornell, (born December 19, 1961, Palo Alto, California, U.S.), American physicist who, won the Nobel Prize for Physics in 2001 for creating a new ultracold state of matter, the so-called Bose-Einstein condensate (BEC). After studying at Stanford University (B.S., 1985), Cornell earned a Ph.D. from the Massachusetts Institute of Technology in 1990. In 1992 he joined the faculty of the University of Colorado. That year he also became a senior scientist at the National Institute of Standards and Technology.

In the early 1990s Cornell began searching for the Bose-Einstein condensate. Some 70 years earlier, in 1924 the Indian Bengali physicist Satyendra Nath Bose made statistical calculations regarding photons, particles of light. Albert Einstein then generalized the result to atomic particles and predicted that if a gas of atoms was cooled sufficiently the atoms would gather in the lowest possible energy state – similar to normal condensation. Seventy years later, in 1995, Wieman and Cornell succeeded in proving this theory experimentally, producing a BEC of 2,000 rubidium atoms at 20 nK (nanokelvin) i.e. 0.00000002 degrees above absolute zero. Cornell's work provided insight into the laws of physics and led to studies on possible practical uses of BECs.

He is currently a professor at the University of Colorado, Boulder campus and a physicist at the National Institute of Standards and Technology, USA. His lab is located at Joint Institute for Laboratory Astrophysics, JILA. He is a Fellow of the American Association for the Advancement of Science (AAAS) and was elected a Fellow of the American Academy of Arts and Sciences in 2005.

'The discipline of writing well forces you to think clearly.'
– Eric A. Cornell