

Indo-US Science & Technology Forum

Connect

Newsletter of IUSSTF

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HERE COMES THE SUN
SOLAR ENERGY RESEARCH INSTITUTE FOR
INDIA AND THE UNITED STATES

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Science and technology collaboration between India and the US has been a very vibrant and multi-faceted one. The major principle behind collaboration in the 21st century has been that joint programs are jointly selected, expenses co-funded and any outcome co-shared. The Indo-US Science and Technology Forum established in March 2000 through an inter-governmental agreement is a co-funded and co-governed autonomous organization, which has now become a special vehicle to administer several such programs.

A shining example of Indo-US S&T collaboration is the establishment of a “virtual” **Joint Clean Energy Research and Development Center (JCERDC)**, to promote joint clean energy research in the areas of solar energy, second generation bio-fuels and energy efficiency of buildings. This 5-year 100 Mn US\$ initiative is funded in public-private partnership mode with 25 Mn US\$ each by the Indian Government (through Department of Science and Technology and Department of Biotechnology) and the US Government (through the Department of Energy) with a matching grant from partnering industries. Three consortia involving about 100 groups from Indian and US academia and industry are working together since 2012 on research topics within these three areas. We have covered activities of the consortium on ‘Energy Efficiency in Buildings’ in the January issue of Connect and the cover story of the current issue is related to the consortium on ‘Solar Energy’, which is the largest of the three JCERDC consortia.

The **India-US Energy Dialogue** was held in New Delhi on 11th March 2014 and was co-chaired by Dr. Montek Singh Ahluwalia, Deputy Chairman of the Planning Commission, and Dr. Ernest Moniz, Secretary, U.S. Department of Energy. India and the United States affirmed their strong commitment to collaborating on energy and promoting greater technological innovation, scientific collaboration, trade, research and development, deploying environment-friendly technologies and products, and promoting sound regulatory frameworks to deliver energy solutions for sustainable growth. The JCERDC consortia members also presented their progress in solar, advanced bio-fuels, and energy efficiency research projects, which were highly appreciated by both the sides. This edition of Connect carries a brief report on the Dialogue and further details may be accessed on the websites of the Indian Ministry of External Affairs and US Department of Energy.

Neuroscience is recognized as an area of great importance both in India and the US. In last two years, IUSSTF has supported 5 workshops/ training programs dealing with different aspects of neuroscience. In this series, a joint workshop was organized by the Indian Institute of Science Bangalore and the Salk Institute for Biological Sciences, La Jolla covering four modules: Vision, Attention & Rhythms, Motor Systems and Learning & Memory with IUSSTF support which is reported in this issue.

It has been IUSSTF's continuous effort to catalyze linkages among the institutions in India and the US. Joint (virtual) R&D Network Centers are such a mechanism to promote joint R&D ties among multi-institutional teams involving at least two institutions each from India and the US. IUSSTF has until now supported 46 Joint R&D Network Centers. In this edition, we are carrying a story on **ClassACT: Indo-US Center for Astronomical Object and Feature Characterization and Classification**, a collaborative Joint Centre partnered by Caltech, CfA/SAO from US and IUCAA Pune and St Thomas College, Kozhencherry.

Intel International Science and Engineering Education Fair (ISEF) is the world's largest science fair. Team India comprising of 18 Indian school children selected from winners of various national science fairs will be participating and competing with more than 1600 children from over 70 countries to showcase their research and bid for more than US\$ 5Mn in awards. These students would then visit selected universities, science parks, museums etc in US to expose them to excitement of science. A send off ceremony was organized at IUSSTF, which was graced by US Ambassador Nancy Powell, S&T Secretary T. Ramasami and senior officials from DST, Intel and various Indian government agencies. We feel proud to mention that with the addition of this new program to our portfolio, IUSSTF now covers a wide spectrum of stakeholders ranging from school children to college students to young scientists through various group targeted activities in addition to core activities that covers scientists and researchers affiliated with academic and research institutions.

IUSSTF feels proud and honored to have several outstanding Indian scientists as our mentors, experts and stakeholders. The Indian Government recognized the contributions of many leading Indian scientists to the Indian and World science this year and decorated them with Padma Awards, the highest civilian honors awarded by the Government to individuals for their outstanding and exemplary contributions in various fields. We salute these scientists!

Also covered in this issue of Connect are brief reports of various regular activities such as workshops, fellowships etc. which we believe would be of interest to our stakeholders and provide examples of the activities IUSSTF supports.

We look forward to your feedback and suggestions for improving this newsletter.

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Here comes the Sun!

Here comes the Sun..... So sang George Harrison years back. And why not? The amount of solar energy falling on earth in one hour exceeds the global energy consumption in one full year! Solar energy can power millions of homes around the world with clean, pollution free energy. In India, more than 30,000 villages and about 50% of households lack access to electricity. They still rely on biomass

combustion, which is inefficient, polluting and has serious health consequences. There is a great opportunity to power these villages with solar energy.

So, what stops solar power? One, despite the recent rapid reductions, solar cost is still high as compared to other fossil based sources. For instance, natural gas prices in the US are at



an all time low because of recent discoveries of shale gas. Two, the technology still needs standardisation to operate in different climatic environments. For instance, dust has a major impact on the efficiency and performance of solar cells and reflectors. Finally, solar power deployment requires technologies for integrating with grid and storing the energy.

Clearly, large scale deployment of solar power requires research to address the above issues and make solar a bankable energy source. It is with this intention that research institutions in India and the US are collaborating in a historic initiative to develop cost effective solar power. The **Solar Energy Research Institute for India and US (SERIIUS)** is a consortium of Indian and US institutions under the Joint Clean Energy Research and Development Centre

(JCERDC) initiated by President Obama and Prime Minister Manmohan Singh. SERIIUS is jointly led by Indian Institute of Science, Bangalore and National Renewable Energy Laboratories (NREL).

SERIIUS: Vision and Objectives

The vision of SERIIUS is to create an environment for cooperation and innovation “without borders” to develop and ready emerging and revolutionary solar electricity technologies toward the long-term success of India’s *Jawaharlal Nehru National Solar Energy Mission* and the *U.S. DOE Sun Shot Initiative*. The overall goal of SERIIUS is to accelerate the development of solar-electric technologies by lowering the cost-per-watt of photovoltaics (PV) and concentrated solar power (CSP). SERIIUS addresses

INDIA	U.S
LEAD INSTITUTION	LEAD INSTITUTION
Indian Institute of Science -Bangalore	National Renewable Energy Laboratory
OTHER PARTNERS	OTHER PARTNERS
Indian Institute of Technology – Bombay (IITB); Center for the study of Science, Technology and Policy (CSTEP); International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI); Solar Energy Centre (MNRE); Indian Institute of Technology – Madras (IITM); Indian Association for the Cultivation of Science (IACS)	RAND Corporation; Sandia National Laboratories (SNL) ; Lawrence Berkeley National Laboratory (LBNL); Arizona State University; Carnegie Mellon University; Colorado School of Mines ; Massachusetts Institute of Technology ; Purdue University; Stanford University; University of Central Florida (Florida Solar Energy Center); University of South Florida; Washington University-St. Louis
INDUSTRY PARTNERS	INDUSTRY PARTNERS
Bharat Heavy Electricals Limited (BHEL); Clique Developments Ltd ; Hindustan Petroleum Corp. Ltd; Moserbaer Ltd; Thermax Ltd; TurboTech Precision Engineering Ltd; Wipro Ltd.; UL India Pvt. Ltd.	Alpha (Cookson Electronics); Corning Incorporated; SunEdison, LLC; Solarmer Energy Inc.

Solar Energy : The Big Picture

The amount of solar energy falling on earth in one hour equals global annual energy consumption! Solar energy can be a source of clean and limitless energy and provide power to millions of homes and electrify remote villages. It can be the panacea to the world's growing energy demand, while not adding to the CO₂ emissions.

Not surprisingly, there has been intense research and development in solar technologies. We have come a long way since Einstein's historic discovery of photoelectric effect in 1905. He observed that when sunlight falls on certain materials, they emit electrons. The first solar cells had an efficiency of less than 1%. Today, solar cells are reported to have almost 45% efficiency though commercial solar cells operate at around 15%. The cost of

solar cells has decreased to about Rs 6 per kWh currently. In addition, solar thermal is another promising option of solar energy conversion. This is based on concentrating solar energy to generate steam, which is used to run turbines and produce electricity, similar to coal and gas fired power plants.

Clearly, solar energy has come a long way. However, additional research is required to develop solar as a mainstream energy source and also the cost needs to reduce further. There is also a need to develop cost-effective technologies for storing solar energy and integrating solar to the grid. With global research in solar, there is optimism that solar energy will soon earn its rightful place in global energy mix as it is the mother of all other energy sources.

critical issues in fundamental and applied research, analysis and assessment, outreach, and workforce development. Throughout this joint effort, a key element is engaging a significant base of Indian and U.S. industry that is dedicated and committed to developing solar energy for *both India and the United States*.

SERIUS includes a large number of Indian and US academic institutions, research laboratories and industries. These combine diverse skills in fundamental science, engineering, economic analysis and policy assessment. It's a complex program because of the technological diversity, geographical separation, research population and quantity of milestones and tasks. **There**

are more than 160 researchers working on 20 projects with about 80 milestones.

Strong Industry-Academia Partnership

SERIUS draws strength from active participation by leading industries in a collaborative mode with academic/research institutions, thus facilitating the development of disruptive technologies from laboratory stage towards commercialization.

SERIUS: Research Thrusts

The SERIUS research agenda is broadly divided into three research thrusts: Sustainable Photovoltaics, Multiscale Concentrated Solar Power and Solar Energy Integration.

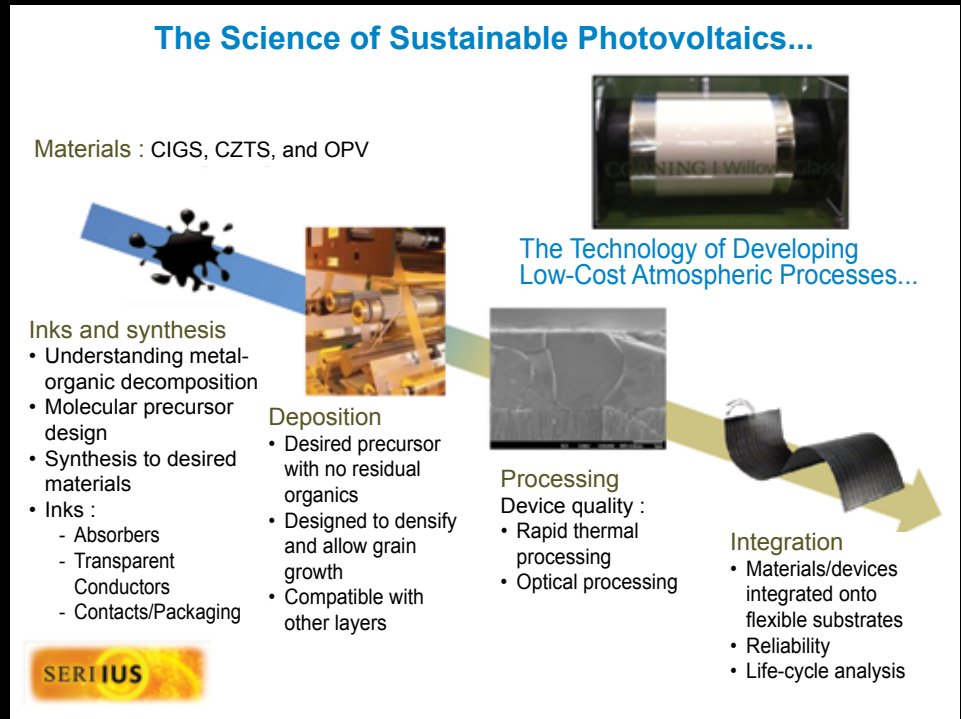
Sustainable Photovoltaics (PV)

The overall objective is to develop new scalable absorbers based on Earth-abundant materials and green processes. Earth-abundant materials are critical to wide-scale deployment in India and the U.S. and to achieve costs approaching the *dollar-per-watt* installed-price SunShot Initiative goal. Key to this entire activity is the underlying proposition that enabling large-scale production of cost-efficient PV for India and the U.S. will necessitate the development of new or improved Earth-abundant PV absorber materials and low-cost scalable associated processes.

The research in this activity builds on extensive expertise within SERIUS in the areas of Si-based PV, thin-film PV (inorganic, organic, and hybrids), and novel nanostructured systems.

The primary research challenge that we will address is to develop Earth-abundant materials in thin-film architectures capable of sufficient efficiency and stability for ultimate deployment in India or the U.S. The basic materials science needed to accomplish this goal is strongly coupled to the second activity area, which is the development of new process technology leading to cost-effective roll-to-roll processing.

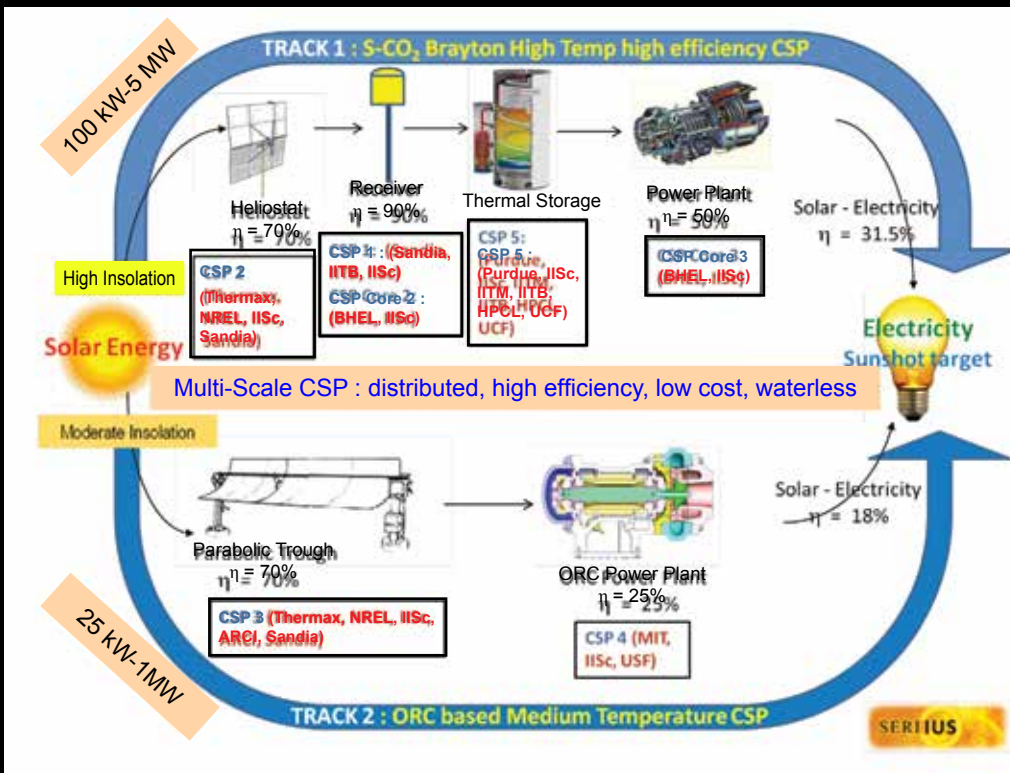
The theme underlying the consortium is to develop basic materials and devices that are ultimately amenable to solution-based, low-cost, low-T deposition wherever possible. In addition to the basic absorber materials science, it is equally important to focus on the interfacial science of junction formation, contacts, and light management for these new materials, systems and device architectures. This approach to SERIUS work is aimed at developing the materials science of these absorbers in a context so that they ultimately are compatible with roll-to-roll processing. Thus, the Sustainable



Photovoltaics Research Thrust focuses on the above coupled activities designed to significantly accelerate the development of disruptive photovoltaic technologies in India and the U.S. and to provide a foundation on which a future Indian PV industry can build.

Multiscale Concentrated Solar Power (CSP)

Conventional Solar thermal power generation involves developing utility scale power plants (50 MW and above). Such large-scale CSP plants based on steam-Rankine cycle have a cycle efficiency of about 35% (for >50 MWe plants). However, such utility scale solar thermal power plants require large tracts of land and water. These could be potentially difficult in India given the competing uses of wasteland. In Indian conditions, an attractive proposition would be to develop distributed scale solar thermal plants without much dependence on water, which could be developed at village level and augment rural electricity. However, at the distributed scale of about 1 MWe, the conventional steam cycle



low receiver temperature (700-800°C) at a plant scale of 100-kW to 5 MWe. Major innovations for this novel power cycle include development of S-CO₂ test loop, solar receivers, heat exchangers, turbo expanders, cost-effective heliostat design and tracking system for Indian conditions.

Medium-temperature Organic Rankine Cycle (ORC) operating at <300°C to develop cycle efficiency >20% (25-kW to 1-MW size): development of test loop, optical coating materials, high efficiency positive displacement ORC expanders, heat exchangers, and cost-effective parabolic trough solar collector with optical efficiency >70%.

Thermal storage and hybridization, to develop hybridized storage systems for the diverse temperature ranges of the Brayton and ORC converters.

Solar Energy Integration

The Solar Energy Integration Thrust focuses on the identification, analysis, and assessment of technical, economic, environmental, and policy aspects for developing and executing solar technologies in India including understanding resources, infrastructure, constraints, scale, deployment scenarios and policy needs. The major *research activities* are: Technology road-mapping, analysis, and assessment; and Solar energy integration and storage analysis.

Projects capitalize on extensive analysis and assessment tools already resident in the consortium including device cost modeling and techno-economic analysis, resource assessment, policy analysis, process modeling

efficiency falls to as low as 20%, rendering such plants economically unviable. For solar plants, the capital cost of setting up a plant is a major contributor to LCOE (levelized cost of energy). In CSP plants, the cost of solar field is typically about 60% of the total cost, so the SERIIUS approach towards significant reduction in LCOE will be two-pronged: increase the power block cycle efficiency significantly, and decrease solar collector cost with innovative designs and optical materials.

With an aim to meet the above objectives, the Multiscale CSP Research Thrust of SERIIUS focuses on high-efficiency, scalable, distributable CSP. This thrust comprises three *research activities* to meet these objectives over a range of scales:

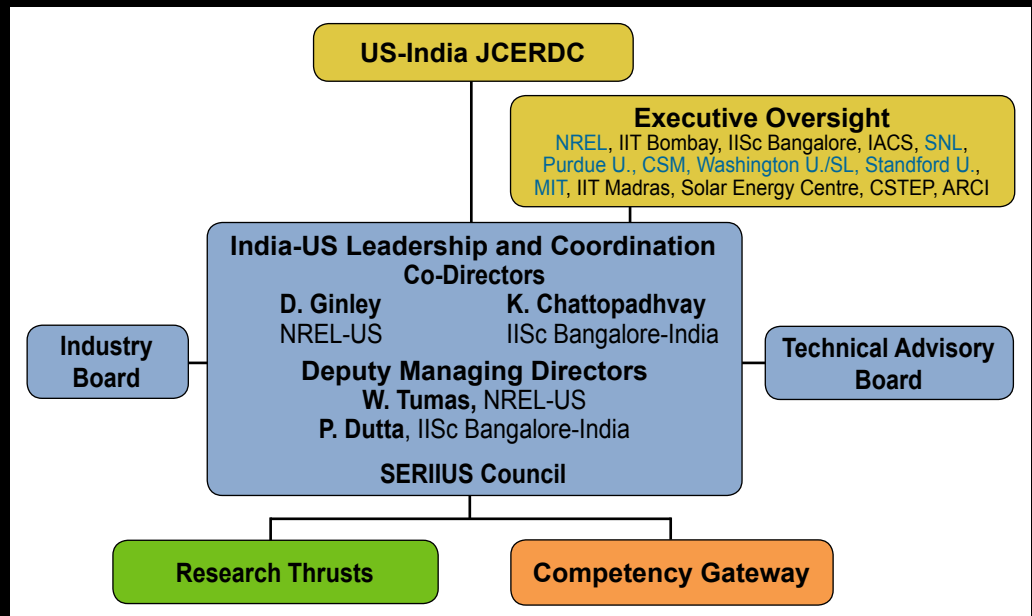
Development of distributed CSP for high solar insolation areas based on Supercritical CO₂ (S-CO₂) Brayton cycle which has the potential of yielding >50% cycle efficiency at relatively

and engineering assessment, systems analysis, and grid modeling. It provides guidance on research priorities and potential impact efficiency to maintain the consortium focus on R&D for new materials, concepts, and systems in the other two thrusts. We will address a number of key issues including: Barriers to deployment of PV & CSP electricity in India and US, identifying R&D needs & technology roadmaps specific to India, Key elements required to address bankability of solar energy technologies and research needs for electrical energy storage.

This Research Thrust is also designed to facilitate alignment and monitoring of the progress of SERIIUS R&D efforts with the critical scientific and technical challenges to achieve large-scale solar energy and to provide the context and guidance for the fundamental and applied R&D on materials, devices, and systems, particularly those elements that are unique to the Indian environment and distinct from existing R&D programs in either country. Work in this area will also be an important part of our outreach program.

SERIIUS Management

SERIIUS has implemented an effective and efficient management plan overseen by highly experienced scientific leaders to enable high-impact R&D, as well as coordination and communication among diverse teams across the three research thrusts. The consortium has established a SERIIUS Council—comprising the directors, research thrust leaders, competency coordinators, and industry board members—to monitor, review, and recommend adjustments of technical activities.



The organization and management structure is designed to facilitate the successful execution of the vision, objectives and strategy. The underlying fundamental principle is that all work and responsibilities are co-shared by individuals and organizations from both India and the United States. *Empowered India-U.S. partnering is the culture of SERIIUS.* The scientific leaders of SERIIUS are empowered by an energetic, leading-edge research and problem-solving environment within an organizational structure that assures that research is focused, flexible and agile.

Conclusions

SERIIUS is an ambitious attempt to develop disruptive solar technologies, which could pave the way for large scale deployment in India and the US. An active collaboration of researchers from universities, research laboratories, and industries is undertaking research in cutting edge solar technologies. These have the potential of significant cost reduction in solar power to make it viable. ●

A *Class* Apart

Data in astronomy have been growing exponentially mainly thanks to large surveys that look at the sky repeatedly to spot variable sources that push the limits of our understanding of the universe. The data volumes are large enough already and not all astronomers put together can “look” at all of it. And this is going to get worse by orders of magnitude in the coming years. In addition, much of the analysis has to be done in real-time as many of these variable sources have to be observed in a matter of minutes before they fade away. This makes it imperative that we teach machines to do most of the “looking” and analyzing data at a rapid rate. In order to do that, different aspects of domain knowledge in astronomy and computing have to come together. There is a parallel in Solar astronomy with a set of large datasets, associated challenges and solutions that have been evolving. The *ClassACT* Indo-US Joint Center has been set-up to solve important aspects of these problems by combining diverse expertise from the US and Indian teams.



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ClassACT aims to characterize and classify astronomical objects and features using dense and sparse light-curves (time-series) and other data (e.g. images, and catalogs there-of, spectra, etc.), from optical to Gamma-rays, with and without additional information, and using simple and advanced statistical techniques available at geographically dispersed locations.

There are three key steps in converting these capabilities into actual science. Each of these

is a complex step involving many, often parallel, steps: (1) Observations – including preprocessing and making catalogs, (2) Detection – by comparison with earlier/older epochs determine which objects/features have changed significantly (e.g. in brightness). These are the ‘transients’ and (3) Classification – this is perhaps the most crucial phase since a large number of transients found would belong to a small number of well-known types. The joint centre goes beyond these efforts in combining the techniques and capabilities to produce a whole larger than the parts in order to find the rare transients. We describe below the main aspects of the different methods and the progress so far.

Classification based on sparse lightcurves

The Catalina Real-time Transient Survey (CRTS) provides one of the main datasets that we use. The survey spans 33000 square degrees and up to several hundred observations for each of the 500 million sources it covers over a time period of ten years. Light-curves can show tremendous variation in their temporal coverage, sampling rates, errors and missing values, etc., which makes comparisons between light-curves difficult and training classifiers even harder. A common approach to tackling this is to characterize a set of light-curves via a set of common features and then use this alternate homogeneous representation as the basis for further analysis or training. Many different types of features are used in the literature



to capture information contained in the light-curve: moments, flux and shape ratios, variability indices, periodicity measures, model representations. The Caltech Time Series Characterization Service aims to extract a comprehensive set of features from any supplied light-curve - currently over 60 features can be supplied. Vectors of such features derived from the light curves of known classes of objects are then used as the training sets for particular supervised classifiers. The methods are general enough to apply to other sets. An example is Decision Trees for classifying blazars, CVS, supernovae etc. built using Gini index. In fact, their applicability elsewhere too is an important emphasis of *ClassACT*. The process of classification in surveys like the CRTS relies on minimal heterogeneous data for probabilistic classification. The priors are updated as more data come in, and more observations may be taken until a scientifically justified convergence is reached. The

PARTNERING INSTITUTIONS IN THE CENTER	
USA	India
<p>Caltech Real-time classification of optical transients. Citizen Science projects for iterative improvement of automated classification methods through human expertise are ongoing.</p>	<p>St. Thomas College Large dimensional sparse matrices for real-time classification of transients, and have expertise in Bayesian networks.</p>
<p>CfA/SAO Classification using dense lightcurves, timing analysis and characterizing solar flares.</p>	<p>IUCAA Hub for statistical techniques, large processing and bringing expertise from all over India as it is an Inter University Center and also the Virtual Observatory India headquarters.</p>



process has to be as automated, robust, reliable, complete (not miss any interesting events), and yet have a low false alarm rate; and it has to learn from the past experience for an ever improving, evolving performance. This is already a critical need for current sky surveys, and it can only grow.

Through collaboration between St. Thomas College and Caltech we have developed an algorithm that uses sparsely populated vectors for classification using the Bayesian approach called Difference Boosting Neural Network (DBNN) to differentiate between them. An important problem is to account for censored data. An example is when observations have been done, but there was no detection. An approach based on this can be naturally incorporated into our Bayesian model by choosing a likelihood function that rules out

values violating the bounds. This approach is useful for classifying not just transients, but also variables.

Besides the transients, the large surveys and some of the follow-up have led to accumulation of large datasets that can be mined as archives for classification in their own right. An excellent example of cross-utility is the solar component of *ClassACT*. The domain is somewhat different from the study of other astronomical transients, and yet the generality of the methodology being developed allows us to use methods that originate with solar data on distant transients and vice versa. Examples of solar features include sunspots, thermal clusters, and various coronal and photospheric phenomena.

A major feature of this work is that it improves upon the existing classification in two ways: first, it eliminates the need to rely on human classification, which is demonstrably unreliable (sunspot groups are often misclassified based on the perception of the individual doing the classification, and in many cases the classification is rigidly held to despite the evolution of the active region), and second, it allows for a continuum of active region characteristics, where a sunspot group evolves smoothly from one state to another. The advantages of such a method is apparent - it allows us to track individual active regions and tag its evolution with the events (like flares and CMEs) observed during its existence. This allows us to carry out finely detailed analyses of their properties, and especially allows for the identification of causal relationships, such as that between field structure and flaring propensity.

Data handling and statistical techniques: All these issues lead to handling of large datasets, storing intermediate products and cross-matching them with diverse and geographically distributed datasets. IUCAA as the VO-India headquarters and the participation of Caltech and CfA/SAO as VAO members ensure that the know-how to do so is trivially present. St. Thomas College is an important VO node too. In addition the AstroStat package operated

from IUCAA is capable of running a plethora of statistical tests at each step of these projects. CRTS, one of the main datasets to be used, originates at Caltech, and the data are also being served from IUCAA. In addition, each institute has its own collaborations on related aspects including citizen science on which it can draw upon.

Recent progress

A joint meeting of *ClassACT* with another Indo-US Joint Center viz. Variable Stars (University of Delhi, SUNY Oswego, University of Florida, Gainesville, Texas A&M University and IUCAA) was held at St. Thomas College, Kozhencherry from January 20th to 24th 2014. The main objective of the meeting was to identify areas of mutual interest in which larger collaborations are beneficial. Besides the IUSSTF joint centre members, Dr. Rajiv Sharma, the Executive director of IUSSTF also participated in the discussions. We also had an actively participating visitor viz. Bruce Bassett from the South African Astronomical Observatory.

The meeting was highly successful with both groups learning from the other and planning related work in addition to their individual groups. To give a specific example, it was seen that the approach to Principal Component Analysis (PCA) was distinct and both groups decided to try the other group’s approach.

Some of the objective goals that resulted from the meeting include the following: (1) Clustering of Kepler objects based on parameters derived from their dense lightcurves. These are the same parameters as described in the Caltech Time Series Characterization Service, (2) Using the DBNN with variable sources from CRTS. An initial sample of 1 million lightcurves will be used with a control sample of 0.5 million non-variables, (3) Extending the DBNN quasar work to identifying candidates from CRTS, (4) Using K-means, unsupervised learning and basis functions to explore the rich CRTS data-space of light-curves and derived parameters, (5) Using Slepian wavelets to study the variability of sources, (6) Crowd-sourcing

set-up using CRTS light-curves and features thereof (an undergrad from IIT-Gandhinagar, Kartik Saxena, is involved in this work), (7) Parallel processing of the 500 million light-curves from CRTS en masse on the IUCAA HPC (the lead is Ajay Vibhute from IUCAA). Besides this, we also thought of several possible extensions synergistically with the other IUSSTF group.

Earlier in the year, there was a visit by two students from St. Thomas College viz. Aruk Kumar and Sheelu Abraham to Caltech where they interacted with the Caltech team members and worked on aspects related to the IUSSTF proposal.

There was another visit by Prof. Vinay Kashyap of CfA to IUCAA to work with Prof. Durgesh Tripathi and his team. They made progress and further plans related to DEM reconstruction, Complex Emissivities, and Spatio-thermal Segmentation.

Outreach

Following the January 2014 group meeting, a special meeting was held at St. Thomas College to introduce IUSSTF and various research funding facilities available to a general audience. Many Masters’ students and graduate students attended and actively participated in the talks and hands-on session. ●



Good memories Ignited minds

In a land that has all but pioneered the study of the mind for thousands of years, cognitive neuroscience is seeing a beautiful resurgence of interest. This was evident to us in our experience with organizing the “3rd Bangalore Cognition Workshop” from 8-21 December 2013 at IISc Bangalore. The final result: 50 extremely inspired and enthusiastic participants (selected with great difficulty out of 455 applications), 27 outstanding speakers who felt invigorated by the enthusiasm and interest of the participants and even organizers who barely felt the usual post-workshop burnout – all made possible through generous support from IUSSTF, DST (Govt of India) and the Wellcome Trust-DBT India Alliance.

the feedback gathered during our workshop, this is where it made the biggest difference.

Our workshop was third in a series of exceedingly popular bilateral workshops that we have organized every other year to promote cognitive neuroscience in India. We devised a novel format for this year’s workshop based on



Over the last two decades, despite virtually no undergraduate programs in neuroscience in India, students from both biology and engineering alike have turned away from the beaten path driven by their curiosity about how the brain works. However for most students, their curiosity is rather undirected because they often have little or no exposure to neuroscience and rarely have the opportunity to interact with neuroscientists. This also makes their transition to neuroscience that much more difficult. From

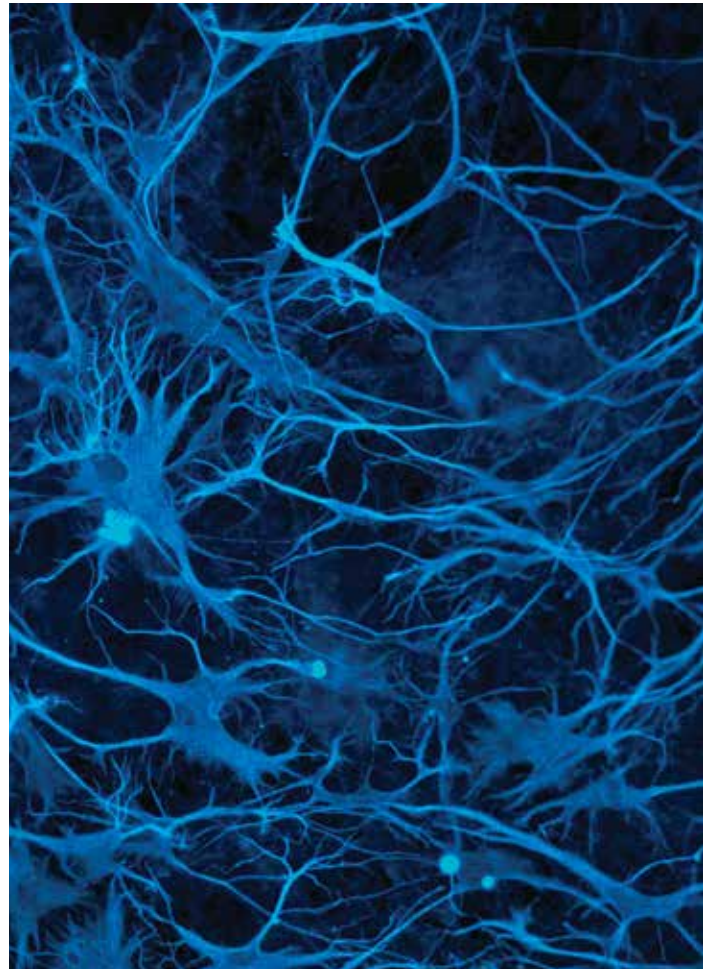


feedback from previous years. The workshop started off with a series of introductory lectures by the faculty of the Centre for Neuroscience at IISc, to introduce the basic concepts and techniques of cognitive neuroscience. The first few days of the workshop had a session by the funding agencies as well as a Public Lecture by Prof Patrick Cavanagh on “The Artist as Neuroscientist”. The workshop was organized around four modules, each lasting three days each: Vision, Attention & Rhythms, Motor Systems and Learning & Memory. Each module had four lectures each day with plenty of time for discussions and ended with a panel discussion and a lab session. In contrast to the lectures which often contained completed answered problems, the panel discussions were aimed at bringing out the major open questions in each area. The panel discussions were very well received by both the participants and the speakers alike. At the end of each module, participants spent an afternoon doing simple experiments that helped consolidate the lecture material and exposed them to the techniques used in cognitive neuroscience. For many students, the highlight of the workshop was just listening to the outstanding lectures by the speakers and interacting with them. The

modular organization served as incentive to the speakers of each module to stay for the full duration, which in turn helped to seed new collaborations as well as allowed for greater interaction with the participants.

Another innovative feature of this year’s workshop was based on our concern that meetings like these generate large amounts of paper cups and plastic waste with obvious environment costs. We therefore made every attempt to reduce the very generation of this waste: all food was served in reusable ceramic plates and cups; clean filtered water was served in reusable glasses; schedules were printed on the workshop notebook, and badges were recovered from the participants for reuse in the next workshop. We earnestly hope other workshop organizers are inspired to follow and even do better.

The saying goes that the mind is not a vessel to be filled but a fire to be kindled. The speakers may only have presented information, the participants may only have asked questions, as organizers we may only have tried to keep the logistics from interfering with the awesome science on display. All of these can be measured and quantified but the most remarkable achievement of the workshop is the most intangible: at the end, we have all gone back with good memories – and ignited minds. ●



Giving **Wings** to Talent

To address the need for human resource development and capacity building in science and technology, the Indo-U.S. Science and Technology Forum (IUSSTF) is committed to nurture contacts between students of science and technology from India and the United States. It has been unambiguously demonstrated that providing students with an exposure to cutting-edge scientific research experiences at a formative stage not only broadens their intellectual horizons but also leads to increased engagements in scientific and technological research careers. In this section of Connect, we share with you the experiences of some of our bright, young interns in their own words!

Khorana Program for Scholars



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Amman Institute of Technology
Tamil Nadu

I would like to take this opportunity to thank everyone involved in the successful conduct of the Khorana Program for scholars. My experience of the Khorana Program 2013 was unforgettable to say the least. As an undergraduate student I was not sure of what to expect going in, but ultimately, I found that participation in this experience was both personally and professionally uplifting! I got an opportunity to work in a group led by

Prof. Ruma Banerjee at the University of Michigan, Ann Arbor. Professor Ruma's excellent leadership and Dr. Carmen Gherasim's comprehensive explanations were invaluable during the course of the internship. I came away from this experience feeling revitalized and inspired. Connecting with amazing individuals united in analogous thoughts was intensely fulfilling, and I feel honoured to be part of the Khorana program.



Being chosen as a Khorana Scholar has given me one of the most wonderful experiences of my life. I was selected to be a scholar at the University of Michigan and for the whole eight weeks I was awed by the immeasurable prospects it had to offer. The best thing about this program is that it gives us a chance to be able to do world class research

at top universities with all the possible facilities just when we are at the point of deciding about our future. We got an opportunity to interact not just with the other Khorana scholars but also the scholars from the S.N. Bose Program which was launched in 2013. Living away from family and friends in a different culture strikes up great friendships and I made friends with some amazing people. It is hard to believe that it will soon be one year but I am still in contact with all of them and I will always cherish the fabulous time we spent together. The Khorana Scholars Program has grown tremendously over the years and I would like to thank everyone who has been a part of it for giving me an experience of a lifetime!



Avantika Gupta
Birla Institute of Technology & Science, Pilani

For more information on the Khorana Program for Scholars:
Webpage: http://www.indoustf.org/Khorana/khorana_program.html E-mail: scholar@indoustf.org

Viterbi-India Program

Inbox of my gmail account with a mail from the Viterbi India administrators made me almost scream in my room! It was time for me to set out to spend my summer in Los Angeles! This internship gave me a great research exposure. I worked in the Ultrasonic Transducer Resource Center laboratory under Prof Kirk Shung. The very word of 'laboratory' took a different meaning when I saw people from different streams like Biology, Chemistry, Electronics and others, working together with great coordination to address a single issue. A real time implementation of my work in a medical imaging system made me feel glad about my project. I also liked the kind of demarcation people have between their work

life and personal life, the kind of encouragement given to different fields like arts, economics and other subjects, which is quite rare to find elsewhere. Apart from our work, we had loads of fun: Universal Studios, Six Flags, a trek to Hollywood sign, and Vegas. Sky diving is something which I would love to do again! And there are a lot of lessons to be learnt from the lifestyle of Americans and the principles they believe in. Thanking the tram driver, parents spending their time with children in museums, parks and observatories, their bright smile and a "hello", which makes you feel at home, and many more. The 8 weeks of internship was an experience of a lifetime!



Bharath V
National Institute of Technology
Karnataka-Surathkal

Viterbi-India Program



It was like a dream come true when I got the opportunity of being a Viterbi-India Scholar and pursuing a research internship at the highly reputed University of Southern California in Los Angeles. The procedure for visa approval and other formalities were very well handed by the IUSSTF staff and the Program Coordinators at USC. The fun part was that I was not alone; rather it was a team of 20 students from various Indian institutions who were to accompany me on this journey. Finally, with a zeal to do something new and the beautiful picture of the city of Los Angeles ingrained in my mind, I flew to the United States.



Prashant Garg
Indian Institute of Technology-
Delhi

The city infrastructure, strict traffic rules, the congeniality and the surroundings amazed me. We were cordially welcomed by the coordinator, Ms Tracy Charles and

other professors on the orientation day. In a meeting with my faculty mentor, Prof. Daniel Dapkus and his PhD student Mr. Yoshitake Nakijama, we carved out the outlines for my project. I worked on modeling of growth of quantum well on GaNnanorods. The project worked out well and the results were more than expected. I presented a poster at the end of my research which was highly appreciated.

This trip was not only restricted to research work. All of us Viterbi-India Scholars became good friends and used to go for sightseeing, trekking etc. on weekends. We also visited Las Vegas and San Francisco and had a lot of fun. The time that I spent in Los Angeles has become part of my memories and encourages me to perform well in academics and other phase of life.

The Viterbi India Program is something I will always hold dear. The eight short weeks I was at USC reiterated my interest in my field of study in a way that was beyond my most optimistic expectations; I got to see first-hand, cutting edge research at its finest and got to work side by side with people who, quite frankly, may have been of mettle well beyond me. I was even afforded the opportunity to work at the prestigious Information Sciences Institute located at the picture-perfect Marina del Rey.

On a more personal level, I believe that the experience has changed me for the better. The people you meet and the care you

receive from your research guides and peer mentors there was well beyond what I have gotten accustomed to - help will always be given at USC when asked for. I had a great time with my fellow research scholars as well, both on campus and off.

There are some very good times to be had in and around LA while staying well within the ample stipend provided. I would also like to specially highlight the great lengths to which Ms. Tracy Charles of USC went to make our stay quite hassle-free and express my heartfelt gratitude for it. I consider it an honour and a privilege to call myself a Viterbi-India Scholar!



Roney Michael
Birla Institute of Technology
and Science-Pilani

For more information on the Viterbi-India Program:

Webpage: http://www.indoustf.org/Viterbi-India/Viterbi_India.html E-mail: viterbi-india@indoustf.org

S.N. Bose Scholars Program

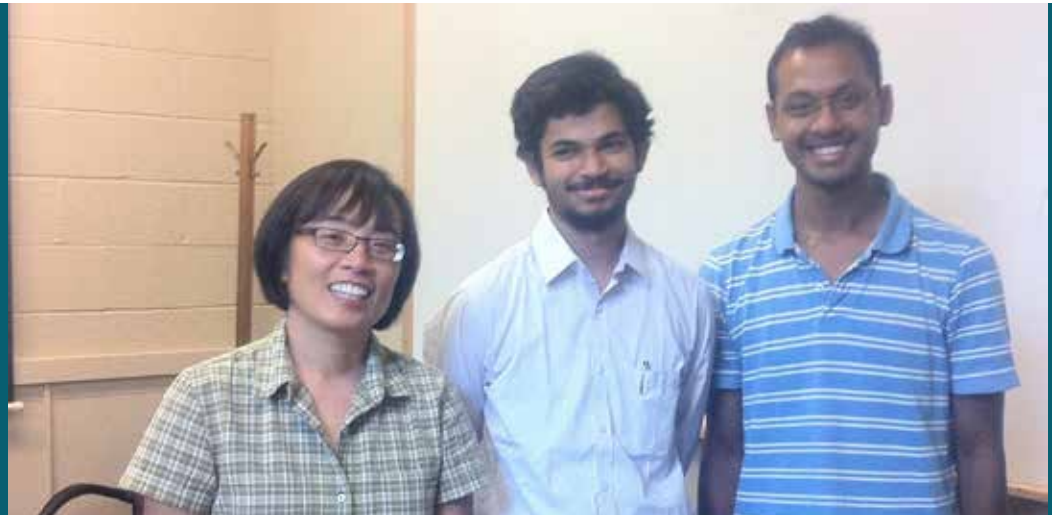
The S. N. Bose Program provided me with the wonderful opportunity to work under Prof. Sridhara Dasu of the CMS team at University of Wisconsin -Madison. By participating in this program, I experienced the everyday life of a particle physicist in the CMS team, and I was absolutely thrilled by it. I have learnt techniques such as Monte-Carlo simulations, and signal-background analysis. I feel lucky to have sat through the CMS team's weekly meetings. I was inspired by the dedication of the professors and students alike. I also visited Fermilab (A U.S. National Particle Accelerator Laboratory) with my mentor and had a splendid time while we toured the facility. My learnings from this

program have not just been academic; I also got to make new friends with my fellow Bose and Khorana scholars. I was humbled by the work ethics and the time sense that the Americans have. Their sense of discipline and cleanliness is something we all could do with, too!

Wisconsin is famous for its dairy products, and I went to see a farm on the outskirts of the city. Also some of us took a trip to Chicago and I was fascinated by the architectural grandeur of the city! All in all, this internship was a great intellectual and cultural experience and I was very fortunate to be a part of this program.



P. S. Chilakalapudi
University of Hyderabad



I got the opportunity to study and conduct research in the United States for a couple of months through the S.N. Bose Scholarship, a student exchange program between leading institutes of India and the United States. I spent two months at the Human Dynamics and Control Laboratory (HDCL) in the University of Illinois, Urbana Champaign closely working with Prof. Elizabeth Hsiao Weckslar. HDCL is developing a portable powered ankle foot orthosis (PPAFO) to help people with gait difficulties walk better. My contribution to its development was to improve the existing electronics, design control circuits for an upgraded version of the PPAFO and get modular printed circuit boards fabricated that could house all the control circuitry required to operate the PPAFO without affecting the gait pattern of the patient.

I had never worked in a lab outside my country and the experience was something completely new to me. I thought all my seniors and peers in the lab were very helpful, humble and welcoming. They made my stay and work in the lab very comfortable and pleasant. I saw for myself how research is done here, the procedures or protocol that are followed or the manner in which a problem is attacked. But the most impressive fact was that although I was an undergraduate researcher, I thought my opinion was heard,

mattered and considered. In an environment such as that, I feel that people would be self-driven towards research, motivation would be a certainty.

My stay here was made all the more special with all the fellow scholars I got to stay with. There were a total of seven scholars visiting this university this year under the Bose and Khorana Program. We were all from different parts of a very diverse country. We spoke different languages and were part of completely different cultures. We would probably never have met each other in our own country or would probably never meet again, yet thousands of miles away in a foreign country, we were united by our nationality. The scholarship gave me a very fortunate chance to interact with and visit one of the best universities in my stream for research. I believe the work I did here would go a long way in helping me prepare for my graduate studies in the future. Having been acquainted with the work culture here, I think it would also become easier for me to study here later. I thank the S.N. Bose program sincerely for this. Moreover, it helped me take a decision as to what I might want to pursue research in, and in what capacity. Overall, the experience was phenomenal and really encouraging.



Souransu Nandi

National Institute of Technology
Durgapur

For more information on the
S.N. Bose Scholars Program:
Webpage: (For Indian Students)
[http://www.indousstf.org/bose/
US-Students.html](http://www.indousstf.org/bose/US-Students.html)
(For U.S. Students)
E-mail: bose@indousstf.org



Dr. T. Ramasami with team IUSSTF

Bidding Adieu...

Dr. T. Ramasami, bid adieu to Government service on 30th April 2014 after serving for eight years as Secretary to the Government of India, Department of Science and Technology. He had assumed the role of Secretary DST in May 2006.

Dr. Ramasami has been tirelessly engaged in the development of policies and programs for the attraction of talent for study and careers in science, rejuvenation of research in universities, stepping-up of international S&T cooperation, development of public-private partnerships in R&D sector and accountability of public funded research, development and demonstration. Under his dynamic leadership, the Department of Science and Technology has aggressively engaged in the development of new models and mechanisms for enhancing the role of public funded institutions in innovations and research and development. Under Dr. Ramasami's guidance, DST launched the "Innovation in Science Pursuit for Inspired Research" or INSPIRE program - an innovative avenue to attract young talent to Science. The basic objective of INSPIRE is to communicate to the youth of the country the creative pursuit of science, attract talent to the study of science at an early age and thus build the required critical human resource pool for strengthening and expanding the Science & Technology system and the R&D base.

Dr. Ramasami has a large number of publications in highly peer-valued journals and significant number of patents. His research experience spans several fields and areas in both basic and applied sciences. His contributions to the understanding of the chemistry and applications of chromium as well as leather science and environment related technologies have earned him several professional recognitions in both India and abroad. These include the Shanti Swarup Bhatnagar Prize for Chemical Sciences in 1993, election to all major science academies as a fellow as well the Third World Academy of Sciences, the National civilian awards Padma Shri in 2001 and Padma Bhushan in 2014.

Dr. Ramasami has served as the Indian Co-Chair of the IUSSTF Governing Board for seven years. In this capacity he has guided IUSSTF and helped us play a pivotal role in the US-India S&T partnership. IUSSTF's programs have grown manifold under Dr. Ramasami's guidance. In addition, IUSSTF's budget too has shown a phenomenal eight-fold increase. We extend our deepest gratitude to him for his contribution to furthering the cause of India-US science and technology collaborations. Dr. Ramasami leaves an indelible mark on all of us. We at IUSSTF salute his visionary and progressive leadership and wish him an active and healthy life ahead! ●



Laurels Galore!

On India's 65th Republic Day, a total of 127 distinguished personalities from various fields were awarded the **Padma Awards** - the country's highest civilian awards. These awards are conferred in three categories - **Padma Vibhushan**, awarded for exceptional and distinguished service; **Padma Bhushan** for distinguished service

of a high order and **Padma Shri** for distinguished service in any field.

It is with a great sense of pride that the IUSSTF family congratulates the following recipients of the Padma Awards for 2014. Our association with you is an honour for us. IUSSTF salutes you for your outstanding contributions to Indian science, engineering and medicine!

PADMA VIBHUSHAN



Dr. Raghunath Anant Mashelkar

National Research Professor
National Chemical Laboratory, Pune and
President, Global Research Alliance

PADMA BHUSHAN



Dr. Thirumalachari Ramasami

Secretary to the Government of India
Department of Science and Technology



Prof. Padmanabhan Balam

Director, Indian Institute of Science
Bangalore

PADMA SHRI



Dr. G. Sundararajan

Director, International Advanced Research
Center for Powder Metallurgy and
New Materials (ARCI), Hyderabad



Prof. Balram Bhargava

Professor of Cardiology
All India Institute of Medical Sciences
New Delhi



Prof. Subrat K. Acharya

Professor and Head
Department of Gastroenterology
All India Institute of Medical Sciences
New Delhi



Prof. Vinod K. Singh

Director, Indian Institute of Science
Education and Research, Bhopal

U.S.-India Energy Dialogue

New Delhi, March 11, 2014



The India-U.S. Energy Dialogue was held in New Delhi on 11th March 2014. The Dialogue was co-chaired by Dr. Montek Singh Ahluwalia, Deputy Chairman of the Planning Commission, and Dr. Ernest Moniz, Secretary, U.S. Department of Energy. The Energy Dialogue is part of the broader Indo-U.S. Strategic Dialogue. The Energy Dialogue was launched in May 2005 with the last meeting held in September 2012 in Washington DC. Secretary Moniz led the U.S. delegation comprising of senior officials from the Department of Energy and various national laboratories. India and the United States affirmed that both countries had a strong commitment to collaborating on energy and promoting greater technological innovation,

scientific collaboration, trade, research and development, deploying environment-friendly technologies and products, and promoting sound regulatory frameworks to deliver energy solutions for sustainable growth.

Officials from the two sides held meetings from 5th March to 11th March, 2014, and reviewed the full range of cooperation under the U.S. – India Energy Dialogue.

The Co-chairs of the dialogue, Dr. Ahluwalia, and Secretary Moniz discussed progress made by the working groups in renewable energy and new technologies, cooperation in shale gas, LNG imports, energy efficiency and low carbon technologies. The joint consortia members from the Indo-U.S. Joint Clean Energy Research and Development Center (JCERDC) also presented on their progress in solar, advanced bio-fuels, and energy efficiency research projects under PACE-R, a unique program for funding joint research by Indian and US institutes.

In 2009, the U.S. and India agreed to significantly increase collaboration under the Partnership to Advance Clean Energy (PACE) for deployment, research and development in clean energy. The PACE program has already mobilized public and private resources to support clean energy research and accelerate the deployment of clean energy technologies, policies and practices.

In their concluding remarks, the two co-chairs expressed satisfaction at the progress made in the energy sector through the co-operative process. They directed the members of the Working Groups to continue their efforts, especially in the newer areas of mutual interest. ●

Text Courtesy:
Ministry of External Affairs, Govt. of India
<http://www.mea.gov.in/press-releases.htm?dtl/23055/IndiaUS+Energy+Dialogue+Meeting+11+March+2014>

Meeting of the IUSSTF Governing Board

21 April 2014



The 15th meeting of the Governing Board of the Indo-U.S. Science and Technology Forum (IUSSTF) took place under the Co-Chairmanship of **Dr. T. Ramasami**, Secretary, Department of Science & Technology (DST) Govt. of India (Indian Co-Chair) and **Dr. Jonathan Margolis**, Acting Deputy Assistant Secretary,

Bureau of Oceans and International Environmental and Scientific Affairs, US Department of State (US Co-Chair) on 21st April 2014 over DVC. The Governing Board members deliberated and provided their views on the accomplishments and also the future vision and role for IUSSTF in promoting its mandate.

Geraldine Richmond visits IUSSTF

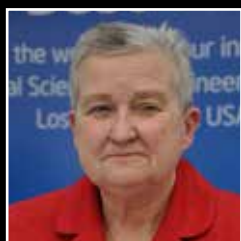
Aside from being an accomplished Chemist and Professor at the University of Oregon, **Geraldine Richmond** is also the President-elect for the AAAS (American Association for the Advancement of Science). Prof. Richmond visited IUSSTF on 31st January 2014 to develop an understanding of how science is conducted in India, as also the role of women scientists and engineers in that context to assess feasibility of establishing formal mentorship collaborations.

She is the Richard M. and Patricia H. Noyes Professor in the Department of Chemistry at the University of Oregon. Richmond received her bachelor's degree in chemistry from Kansas State University (1975) and her Ph.D. in chemical physics at the University of California, Berkeley (1980). She has distinguished herself in her research using nonlinear optical spectroscopy and computational methods applied to understanding the chemistry that occurs at complex surfaces and interfaces that have relevance to important problems in energy production, environmental remediation, atmospheric chemistry and biomolecular surfaces. Over 160



publications have resulted from this research. Prof. Richmond has also played an important role in setting the national scientific agenda through her service on many science boards and advisory panels. She is the founder and chair of COACH (Committee on the Advancement of Women Chemists), an organization assisting in the advancement of women faculty in the sciences. Over 3,000 science faculty, students, postdocs and administrators have benefitted from professional training and networking workshops developed by COACH. ●

All the Best Team India



My message to you is make sure you stay focused on your studies, make sure you attend and graduate from university. Continue to be inquisitive, explore new avenues of research, innovate, and dream about how you can make a difference. The sciences give you limitless possibilities to experiment and invent.

Ambassador Nancy Powell

In a special ceremony held at the Indo-US Science & Technology Forum in New Delhi on 21 April 2014, 18 students were felicitated for being the best talent selected from across the country and holding the honor to represent India at an international platform - Intel® International Science and Engineering Fair (ISEF) to be held in Los Angeles, California from May 11-16, 2014 - as TEAM India.

Department of Science & Technology, Indo-US Science & Technology Forum and Intel came together to celebrate these young geniuses as they get ready to compete at the international forum. TEAM India was given a send-off by United States Ambassador to India, Ms. Nancy J. Powell and Dr. T. Ramasami, Secretary, Department of Science and Technology, Government of India along with delegates from various organizations.

In the ceremony, the winners of the IRIS 2013, now TEAM India 2014, were congratulated and given an opportunity to interact with scientists, professors and other eminent guests and

showcase their respective projects. Out of the 18 students, 3 are junior observers and 15 are the finalists who would be competing amongst 1600 young students from 78 countries at the world's largest pre-college science fair, the only global science competition for students in grades 8-12.

The event marked the beginning of a new partnership between the Department of Science & Technology, Indo-US Science & Technology Forum and Intel as the three came together to extend the opportunity of more projects to reach the international stage; and provide for the learning week post Intel ISEF.



IUSSTF is delighted to be part of this initiative that provides an opportunity to talented young students to showcase their ability and aptitude on the grand global stage that ISEF is. The one-week science learning tour in the United States would encourage them to explore the exciting world of Science. I wish these students all the very best, and hope they will make India proud!

Dr. Rajiv Sharma
Executive Director, IUSSTF





'Encouraging more students to adopt science research as career is one of the highest priorities of DST. ISEF would provide a platform to these talented students for showcasing their potentials as well as interaction with students from other countries. The ISEF site visits would expose them to the excitement of science and motivate them to pursue science in their further studies.'

Dr. T. Ramasami
Secretary, Department of Science and Technology, Govt. of India



'Both TRIS and Intel® ISEF are influential in highlighting the unique pool of creativity and innovation that exists in the country. This year, with 12 projects being selected for ISEF we have a greater opportunity to showcase the talent existing within the youngsters of the country, encouraging them to create realistic solutions, through research practices, to scientific challenges that are vital for tomorrow's progress.'

Ashutosh Chadha
Director - Corporate Affairs Group
Intel South Asia



Team India will also receive an immersive experience of the scientific and the entrepreneurial culture of the United States. The Team India will visit some of the best universities, research institutions, science museums, research parks and start-ups in USA. It is envisaged that such an exposure will encourage students and create excitement of creative pursuits of STEM education and motivate young students to undertake research in the frontier areas of science & technology and also develop a spirit of innovation and entrepreneurship. The site visits, not only will showcase the scientific landscape of USA but will also provide an opportunity to the students to assimilate a wider perspective for future studies and possibilities of participating in collaborative research programs. ●

ADVANCED TURBO-MACHINERY: POWER GENERATION AND TRANSPORTATION FOR A SUSTAINABLE AND ENVIRONMENTALLY RESPONSIBLE FUTURE

06-07 January
Mumbai, India



Turbo-machineries are an integral part of today's society and economy. They cover a large variety of machines such as gas turbines for power generation and aviation; wind turbines; steam turbines for coal-based, nuclear, solar thermal and geothermal power plants; hydro power plants. In fact, more than 98% of electric power that is added to the US electric grid is aided by a turbo-machine, and almost 100% of passenger-miles are flown by turbine-powered airplanes. As the above systems involve significant capital investments with a long service life, and since many of the newer technologies being proposed have uncertain or unknown long-term reliabilities, and have severe cost barriers, there is a need for more research and development, in complete partnership between academia and industry, in order to bring the newer technologies to the market at a cost that the society can pay.

The Indo-U.S. workshop on **Advanced turbo-machinery: Power generation and transportation for a sustainable and environmentally responsible future** organized by **A.M. Pradeep** (Indian Institute of Technology-Bombay), **Bhaskar Roy** (Indian Institute of Technology-Bombay), **Jayanta Kapat** (University of Central Florida) and **Farrukh Alvi** (Florida State University, Tallahassee) intended to lay the foundation for vigorous discussions resulting in concrete plans for bilateral collaboration. The workshop identified the following key areas for possible collaboration between the two countries - advanced materials; coating and corrosion control; risk based inspection strategies; materials for environment; component dynamics of a system; multi-disciplinary optimization methodologies; and, additive manufacturing and materials technologies. ●

MASS SPECTROMETRY-BASED PROTEOMICS AND METABOLOMICS IN DISEASE BIOLOGY

23-24 January
Thiruvananthapuram, India



Over the last decade, genomics and proteomics have been used as important tools to better understand the complexities in biology, and to discover diagnostic biomarkers and drug targets. To integrate the above two "omics" in systems biology, metabolomics, a new science is evolving for analysing the basic metabolic changes taking place in a living organism. Metabolomics is an emerging novel field of

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research tools concerned with the comprehensive characterization of small molecule metabolites generated in a particular cellular process. The Indo-US workshop on **Mass spectrometry-based proteomics and metabolomics in disease biology** organized by *M. Radhakrishna Pillai* (Rajiv Gandhi Center for Biotechnology, Thiruvananthapuram) and *K. Sreekumaran Nair* (Mayo Clinic, Rochester) aimed to bring together an outstanding panel of scientists and investigators to discuss how advances in analytical technologies and data

mining tools could be exploited for addressing the challenges in the prevention and treatment of various diseases in India. The workshop emphasized on discussions around the current technological challenges in metabolomics such as defining and annotating the metabolome; spatially resolved sampling and temporal flux measurements; instrumentation, dynamic range, depth-of-coverage and infrastructure; and, informatics, databases, and standardization. ●

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

01-02 February
Pune, India



Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of mortality and morbidity both in the developed as well as developing countries of the world. COPD is the third leading cause of death in the United States, while it is one of the top five causes of death in India. By 2030, COPD will become the third leading cause of death in the world. COPD is a silent epidemic in India, with very little awareness about the disease amongst lay people, healthcare providers, healthcare policy makers and researchers. The Indo-U.S workshop on **Chronic Obstructive Pulmonary Disease** organized by *Sundeep Salvi* (Chest

Research Foundation, Pune) and *Shyam Biswal* (Bloomberg School of Public Health, Johns Hopkins University, Baltimore) aimed to bring together American and Indian clinicians, healthcare providers, healthcare policy makers and researchers to bridge the gaps in knowledge that each country has in the field of COPD prevention, control and management. The main objectives of this workshop were to develop ideas that will guide future research and funding support in the area of interventional and preventive strategies for COPD, indoor air pollution and non-smoking factors related to COPD, respiratory infections and other co-morbidities to decrease the burden, mortality and morbidity associated with the diseases; bring together investigators from both countries on a common forum to exchange knowledge and expertise to improve the understanding of COPD, investigate the mechanisms of disease development and help develop novel prevention strategies directed to the affected population in the future; phenotyping and management of COPD; translation of basic research to develop novel therapies; medical education to combat COPD; risk communication and public awareness of COPD in Indian population; and, develop strategies to overcome funding, research and public health policy challenges. ●

COGNITIVE RESERVE IN DEMENTIA AND APHASIA: INTERACTION BETWEEN LIFELONG EXPERIENCES AND NEUROBIOLOGY

02-04 February
Hyderabad, India



The recent years have witnessed a rising number of people with cognitive disorders coupled with an increasing interest in understanding their scientific basis. Significant advances made in clinical characterization of disease, use of advanced neuroimaging techniques, and evidence from longitudinal studies has shifted focus from pathology towards risk and protective factors for Alzheimer's disease and other dementias. The Indo-U.S. workshop on **Cognitive reserve in dementia and aphasia: Interaction between lifelong experiences and neurobiology** organized by *Suvarna*

Alladi (Nizam's Institute of Medical Sciences, Hyderabad) and *Mary Ganguli* (University of Pittsburgh) put together a research collaboration between neuroscientists in the United

States and India, to further the understanding of cognitive reserve and develop prevention strategies from cognitive disorders in the Indian as well as international context. ●

ADAPTATION OF RURAL COMMUNITIES TO CLIMATE CHANGE: BRIDGING THE GAP BETWEEN ACADEMIA AND COMMUNITY WORKERS AND IDENTIFYING RESEARCH NEEDS

20-21 February
Bengaluru, India



Climate change and its impact on livelihoods has been the center of research for the past decade, and will continue to be so in the coming years. The fourth assessment report of the Intergovernmental Panel on Climate Change states that “Climate change is projected to impinge on the sustainable development of

most developing countries of Asia, as it compounds the pressures on natural resources and the environment associated with rapid urbanisation, industrialisation, and economic development”. An Indo-U.S. workshop on **Adaptation of rural communities to climate change: Bridging the gap between academia and community workers and identifying research needs** was organized by *Harini Nagendra* (Ashoka Trust for Research in Ecology and the Environment, Bengaluru), *Pinki Mondal* (Columbia University, New York) and *Ruth DeFries* (Columbia University, New York) with the aim to learn from physical and social scientists working with geospatial technologies, meteorological station data, ground surveys, socio-economic surveys, census data and other data sources/techniques and understand ongoing and future climate change and its impacts on rural livelihoods. The other component of this event was to learn from community workers and/or non-governmental organizations that have on-the-ground experience with adaptive capacity of vulnerable communities. ●

VIRAL INFECTIONS OF THE NERVOUS SYSTEM

25-28 February
New Delhi, India



Infections of the central nervous system (CNS) have devastating consequences ranging from death of the patient to neurological sequelae in survivors. Viruses are a common cause of CNS infections in humans. There is increasing evidence that new

neurotropic viruses, mostly of zoonotic origin, emerge regularly. Many of these viruses can lead to outbreaks, thus increasing their public health importance. Concrete data on the burden of different neurotropic infections are however limited.

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The primary goal of the Indo-U.S. workshop on **Viral infections of the nervous system** organized by **Pankaj Seth** (National Brain Research Centre, Manesar), **Jayasri Das Sarma** (Indian Institute of Science Education and Research, Kolkata), **Lynn Pulliam** (University of California, San Francisco) and **Randall. J. Cohrs** (University of Colorado School of Medicine, Aurora) was to bring together the pioneers of this field on a single platform to nurture their research ideas

as well as explore the potential collaborates in areas of mutual research interests. This meeting involved 50-60 basic researchers, clinical scientists and trainees working in the areas of neurology, neuropathology, neuropathogenesis, neurobiology, neuroimmunology, neurochemistry, and molecular virology of the CNS. One of the major themes was to discuss the molecular mechanisms associated with virus-induced neurologic diseases in humans and animal models. ●

SENSOR TECHNOLOGIES AND SENSOR MATERIALS FOR SMALL SATELLITE MISSIONS RELATED TO DISASTER MANAGEMENT

31 March-02 April
Bangalore, India

Successful efforts of Indian and American organisations in the application of satellite technologies for the management of numerous disasters have had notable outcomes in terms of saving human lives and resources. Recent years have seen the increased applications of small satellites (micro and nano satellites) in disaster management not only because of their time and cost advantages, but also due to their utility in preparedness, response and recovery in the case of disasters. Continuously evolving small satellite technologies demand reliable, robust, cost-effective and easy-to-fabricate sensors and devices such that they complement the specific needs of small satellite missions. The Indo-U.S. workshop on **Sensor technologies and sensor materials for small satellite**

missions related to disaster management organized by **G. Mohan Rao** (Indian Institute of Science, Bangalore) and **Suraj P. Rawal** (Lockheed Martin Space Systems, Denver) was aimed at the identification and further development of mutually agreed small-satellite sensor technologies with an ultimate aim of serving the disaster management needs. The uniqueness of the workshop was its ability to network experienced Indo-U.S. groups with rich credentials in sensors and sensor materials such that joint development projects are engendered through effective sharing of risks, costs and resources. These envisaged projects will have innate focus on serving the socio-economic causes and technology-development needs of both the countries with compliance to the existing frameworks. ●

JCERDC Meeting at IUSSTF

As a prelude to the U.S.-India Energy Dialogue, a meeting of the Indo-U.S. Joint Clean Energy Research and Development Center (JCERDC) was held at the Indo-U.S. Science and Technology Forum on 10th March 2014. The meeting was chaired by Mr. Jonathan Elkind (Assistant Secretary for International Affairs, U.S. Department of Energy) and Dr. Renu Swarup (Adviser, Department of Biotechnology, Govt. of India). The three JCERDC consortia made brief presentations giving an overview

about their projects as well as highlighting the progress achieved thus far. The meeting was attended by representatives from the Indian Department of Biotechnology, Department of Science and Technology, Ministry of New and Renewable Energy, Department of Agricultural Research and Education, Ministry of Urban Development and the Ministry of Petroleum, as well as U.S. Department of Energy and PACE-D/USAID coordinators. ●





Indo-US Science & Technology Forum

Who we are

The Indo-US Science and Technology Forum (IUSSTF), established under an agreement between the Governments of India and the United States of America, is an autonomous, not for profit society in India, co-funded and co governed by both the governments. IUSSTF promotes and catalyzes Indo-US collaborations in science, technology, engineering, biomedical research and innovation through substantive interaction among government, academia and industry.

What we do

- Foster** excellence by capitalizing on the scientific and technological synergy
- Disseminate** information and create awareness through scientific exchanges
- Build** linkages through networking between academia and industry
- Explore** new frontiers by nurturing contact between young and mid-career scientists
- Pave** way to sustainable interactions and establish long term relationships
- Encourage** public-private partnership to inculcate elements of innovation and entrepreneurship

We support

Exciting and innovative collaborative programs cutting across disciplines and institutions

- Academia-Industry Connect Programs
- Advance Schools & Training Programs
- Bilateral Workshops & Symposia
- Flagship Events
- Knowledge R&D Networked Joint Centers

- Programs on Innovation and Entrepreneurship
- Public-Private Networked R&D Joint Centres
- Research Fellowships for Faculty
- Special Initiatives for Strategic Partnerships
- Student Internships & Visiting Professorships

We invite

Proposals which are peer reviewed both in India and USA for awards

Bilateral Indo-US Workshop/Symposia & Indo-US Training/Advanced Schools

Submission Deadlines
 15 February
 15 August

Award Announcements
 30 June
 31 December

Indo-US Public-Private Networked Centres & Indo-US Knowledge R&D Networked Centres

Submission Deadline
 15 August

Award Announcement
 31 December

How to contact us?

For program details visit:

<http://www.indousstf.org>

**Indo-US Science and Technology Forum:
Catalysing Indo-US Science & Technology Cooperation over a decade.**