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NEWSLETTER

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1. SCOSTEP 2016 Awards

Recognizing the societal importance of studies in the field of solar-terrestrial physics and in order to give credit to scientists who contribute significantly to these studies and to SCOSTEP activities, the SCOSTEP Bureau has recently instituted three awards: SCOSTEP Distinguished Science Award, SCOSTEP Distinguished Young Scientist Award, and SCOSTEP Distinguished Service Award. The SCOSTEP Distinguished Young Scientist Award is given to young scientist who achieved considerable success in solar-terrestrial physics and took an active part in SCOSTEP-related activities. The SCOSTEP Distinguished Science Award is given in recognition of an outstanding contribution of a scientist to SCOSTEP science.

After a number of nominations from the solar-terrestrial community at large, the Awards Selection Committee unanimously selected and recommended to the SCOSTEP Bureau that Dr. Brett Anthony Carter and Dr. Nicholas Michael Pedatella be the recipients of the SCOSTEP Distinguished Young Scientist Award for 2016 while Dr. Xin Cheng be given an Honorable Mention. Prof. Sami Khan Solanki was unanimously selected to be the recipient of the SCOSTEP Distinguished Science Award for 2016. The SCOSTEP awards will be presented at the Award ceremony during the 1st VarSITI General Symposium in Albena, Bulgaria, June 6 - 10, 2016.

2. SCOSTEP Awards 2016 – Citations

2.1 Distinguished Scientist Medal – Prof. Sami K. Solanki

Prof. Sami Khan Solanki, *Director of the Max Plank Institute for Solar System Research, Germany is the recipient of the* ***SCOSTEP Distinguished Scientist Award*** *for 2016 for his profound contributions to all aspects of the influence of solar variability on Earth's climate, including development of physics-based irradiance models, which provide a basis for understanding the spectral solar irradiance variability, as well as to a broader understanding of solar magnetism.*

Prof. Solanki is one of the world's leading solar and heliospheric physicists. Among his broad interests and expertise, the topics closely linked to solar variability and its influence on the Earth environment occupy a special place. In particular, his research has contributed decisively to our understanding of the physical mechanisms of solar irradiance variations on time scales of days to centuries and to the development of models allowing reconstructions of solar activity for historic and pre-historic times. All of these are topics of great interest and paramount importance for understanding and modelling global change of Earth's climate.

Over the last four decades enormous progress has been made in understanding the mechanisms of the solar irradiance variability, not least due to the contributions of Prof. Solanki. Some of the achievements of the work led by Prof. Solanki or with his active contribution, include:

1) The development of the SATIRE set of physics-based irradiance models that have clearly proven the magnetic field at the Sun's surface to be the source of irradiance variations on time scales longer than a day. The model reproduces over 95% of the directly measured total solar irradiance variations (TSI) and is currently the only model reproducing the observed changes in the TSI levels during the last three activity minima, including the most recent, comparatively deep minimum in 2008. The SATIRE model allows calculations of both the total and spectral (SSI) solar irradiance, and plays a crucial role in our current understanding of the SSI variability.

2) The physical explanation of the origin of the secular change in the solar surface magnetic field and irradiance, since it is this presumed background variation in the solar irradiance which is most likely to affect Earth's climate on decadal and longer time scales and is of most relevance to global climate change studies. Prof. Sami Solanki was the first to point out the crucial role of the ephemeral magnetic regions in building up and changing the so-called background magnetic flux.

3) The first physics-based reconstructions of solar activity, including the solar surface and heliospheric magnetic field, the sunspot number and the irradiance, over the Holocene. The reconstructions are based on cosmogenic radionuclides (14C and 10Be) measured in independently dated stratified natural archives. This was the first time the full chain of processes between cosmogenic isotope concentrations and concrete solar parameters (such as total or open magnetic

flux, or the sunspot number) was described by physics-based models. These reconstructions confirm the great variability of solar activity on centennial-millennial scale, from Grand minima to Grand maxima.

4) The observations (including both analysis and development of the instrumentation) of the Sun that provided critical information on the structure and brightness of magnetic features on the solar surface. In recent years Prof. Solanki led the Sunrise balloon-borne project, which obtained by far the highest resolution images of the Sun in the 200–400 nm wavelength range, which is crucial for ozone chemistry in the Earth's atmosphere, revealing the high brightness of small-scale magnetic features at these wavelengths. These results are now flowing into the testing of solar model atmospheres and thus contribute to the development of the next generation of solar irradiance models.

Prof. Solanki has over 740 scientific publications, of which over 400 (excluding reviews) were published in refereed scientific journals. He has also published 75 review papers in refereed journals, book chapters and in conference proceedings. These papers have been cited over 14 000 times, with an h-index of 63 (according to Web of Science, February 2016). Of these, over 180 (over 100 refereed and 35 reviews, partly also refereed) papers are directly related to the SCOSTEP research field.

The recognition of his contribution to the solar variability and solar-terrestrial studies is also reflected in the number of invited plenary, review and keynote talks that Prof. Solanki has given at international scientific meetings amounting to 106, of which about 50 cover topics within the SCOSTEP field, such as solar variability, solar irradiance, solar activity in the past and the heliospheric magnetic field, variability of Sun-like stars of relevance to solar variability. As a Scientific Organizing Committee member, he has contributed to the organization of 16 meetings directly on SCOSTEP topics and many more on related topics.

Prof. Solanki enthusiastically supports younger people in their science career. Beside numerous lecture courses that he has given at various universities across the world (e.g., ETH Zürich, Switzerland; University of Utrecht, Netherlands; Universities of Göttingen and Braunschweig, Germany; Kyung Hee University, South Korea) and at international summer and winter schools, he is the founder and the spokesperson of the International Max Planck Research School on Physical Processes in the Solar System and Beyond (IMPRS) at the Universities of Göttingen and Braunschweig. This research school has so far resulted in 155 completed PhD theses.

Prof. Solanki has personally supervised 39 PhD students with completed theses and is currently supervising six more. Of these, 12 students did theses on SCOSTEP-related topics. Prof. Solanki is the Principal or Co- Investigator of numerous space instrument projects. Of these, experiments like VIRGO (Variability of Solar Irradiance and Gravity Oscillations) on SoHO (Solar and Heliospheric Observatory), SOVIM (Solar Variability and Irradiance Monitor) on ISS, SECCHI (Sun Earth Connection Coronal and Heliospheric Investigation) on STEREO (Solar Terrestrial Relations Observatory), HMI (Helioseismic and Magnetic Imager) on SDO (Solar Dynamic Observatory) and the Sunrise Balloon-Borne Solar Observatory have already provided and continue providing invaluable information for studies of solar variability and activity, solar irradiance and the heliospheric magnetic field, which is crucial to understanding the mechanisms through which the Sun affects Earth's climate system. He is also involved in several other highly relevant experiments currently built, including the Polarimetric and Helioseismic Imager (PHI), the Extreme Ultraviolet Imager (EUI), SPICE and METIS instruments on Solar Orbiter, and the Solar Ultraviolet Imaging Telescope (SUIT) on the ISRO Aditya L1 Mission.

Since 2011 Prof. Solanki has been a Scientific Discipline Representative of the Scientific Committee for Solar Terrestrial Physics (SCOSTEP). He has also actively participated in the German national programs within the SCOSTEP field: the DFG (Deutsche Froschungsgemeinschaft) priority program CAWSES in the period 2005–2011 and the national ROMIC (ROle of the Middle atmosphere In Climate) project of the Federal Ministry of Education and Research, which began in 2013.

2.2 Distinguished Young Scientist Medal – Dr. Brett A. Carter

Dr. Brett Anthony Carter *from the Space Research Centre, RMIT University, Melbourne, Australia is the recipient of the SCOSTEP* ***Distinguished Young Scientist Award*** *for 2016 for his innovative approach in the study of the occurrence of equatorial plasma bubbles (EPBs) and of geomagnetically induced currents (GICs) producing results of considerable importance for the understanding of the origin and manifestation of these phenomena.*

Dr Carter has made significant advances in two important areas in solar-terrestrial physics; (1) the occurrence of equatorial plasma bubbles (EPBs), which affect trans -

ionospheric radio communications and navigation signals, and (2) geomagnetically induced currents (GICs) at equatorial latitudes. The problem of EPBs has been a hot research topic for decades in ionospheric physics, and has become an even more important issue now that society relies so heavily upon space-based navigation and timing signals, such as those from the Global Positioning System (GPS) satellites.

Dr Brett Carter demonstrated that a global coupled thermosphere-ionosphere physics-based model replicated, to a high degree, the observed daily variability in the occurrence of GPS scintillation events (i.e. EPBs) at multiple locations around the world. He further found that small changes in geomagnetic activity were the main driver of daily EPB variability. His findings have significantly contributed towards successful prediction of the occurrence and properties of EPBs on a daily basis, an achievement the field has been striving towards for decades. The new EPB prediction capability that Dr Carter has developed requires no ground infrastructure, but only data from the ACE/WIND space-craft upstream in the solar wind. He is currently working on translating this research finding into an operational product that will distribute GPS and VHF/UHF scintillation forecasts for users around the world.

The second topic that Dr Carter has significantly advanced through his research is GICs at equatorial latitudes, another hot topic in the field of solar-terrestrial physics. In this research area, he has made two important discoveries: (1) confirmed that the equatorial electrojet effectively amplifies the magnetic field signatures of inter-planetary shock arrivals, and (2) that these amplifications occur under both disturbed and quiet geomagnetic conditions. The former finding has significant implications for nations located at the magnetic equator whose electrical power grids would not have been designed to cope with adverse space weather conditions. The latter finding has much broader implications and it has led to the realization that GICs are not only a problem during severe geomagnetic disturbances, but also during quiet geomagnetic conditions.

Dr Carter's work on GICs at the equator has received global media attention, which has once again focused upon the area of solar-terrestrial physics, and on the societal impact of space weather more generally. His work was published in August 2015 in the Geophysical Research Letters has already received very considerable positive attention from within the scientific community, being highlighted as one of the top 10 papers on GICs in the last 55 years and is very likely to become known as one of the seminal papers in this field. Dr Brett Carter has published a total of 19 refereed publications (10 as first author), 5 scholarly book chapters, and 12 refereed conference proceedings papers. His works have been cited more than 100 times, and 60 of those citations have occurred within the last 2 years. His presentation on EPBs at the 14th Ionospheric Effects Symposium in Alexandria, VA, USA won him the Young Scientist Best Paper Award.

In addition to his scientific contributions to solar-terrestrial physics, Dr Carter has an active online presence in a scientific outreach capacity that includes 6 science media articles published on solar-terrestrial physics and space weather topics with more than 150,000 readers around the world. Dr Brett Carter is a rising young scientist that has demonstrated excellent potential in his short career to date.

2.3 Distinguished Young Scientist Medal – Dr. Nicholas M. Pedatella

Dr. Nicholas Michael Pedatella *from the University Corporation for Atmospheric Research (UCAR), USA is the recipient of the SCOSTEP* ***Distinguished Young Scientist Award*** *for 2016 for his work on atmospheric variability and data assimilation and ground-breaking contributions to our understanding of the influence of lower atmospheric waves on the spatial and temporal variability of the mesosphere, ionosphere, and thermosphere.*

Dr. Nicholas Pedatella's in-depth study using GPS TEC observations as well as simulations including solar and lunar tides, have established the mechanisms that are involved in coupling the sudden stratospheric warming (SSW phenomenon to ionospheric variability. He has also identified the ENSO phenomenon as a possible tropospheric source of ionospheric variability. His large number of refereed publications (35) with 27 as first author, high citations (h-index of 14) and 6 invited talks in major international conferences, point to the significant impact that his work has already had in the field. He is the team leader for an ongoing International Space Science Institute International study on ground-to-space understanding of SSWs.

During his postdoctoral fellowship within the NCAR Advanced Study Program he studied the variability of migrating and non-migrating tides due to the presence of traveling planetary waves (PW). This work was motivated by his analyses of tidal signatures in the thermosphere and ionosphere using satellite and ground-based observations. Using NCAR's numerical models, he unambiguously demonstrated that the mean wind changes do not significantly affect either the migrating or non-migrating tides, and that the tidal variability is mainly caused by the nonlinear PW and tidal interaction and zonal asymmetry introduced by the PWs. Dr. Pedatella's work on lunar tides is particularly noteworthy. Interest in lunar tides has grown since analyses of thermosphere and ionosphere observations (including analyses he conducted) indicated that the lunar semi-diurnal tide signal in the ionosphere is strong during sudden stratospheric warming (SSW) events. Dr. Pedatella demonstrated, using a combination of global atmospheric and ionospheric models, that both the magnitude and phase of the simulated vertical drift perturbation during SSW improves significantly compared with observations when the lunar tide is included. This study provides the most definite evidence in support of lunar tidal impacts on the ionosphere during SSW so far. Finally, Dr. Pedatella's more recent study of ENSO control of upper atmospheric tides provides new insights in the link between tropospheric climate and near space environment.

Equally at home with using large numerical models and analysis of satellite and ground based observations, Dr. Pedatella has more recently focused on the development and application of data assimilation techniques. Within a relatively short time he successfully collaborated with researchers outside of his scientific discipline to implement a data assimilation system using the NCAR Whole Atmosphere Community Climate Model. He has used these to better understand the short-term variability in the middle and upper atmosphere and the response of the ionosphere to geomagnetic forcing. His scientific breadth is further demonstrated by his most recent work that aims to improve ionosphere remote sensing techniques. One example of which is his development of an improved inversion of ionospheric electron density profiles from FORMOSAT-3/COSMIC observations.

Dr. Pedatella has already shown scientific leadership in STP research. He is the team leader for an on-going International Space Science Institute International Team on the "A three-dimensional ground-to-space understanding of sudden stratospheric warmings." Within that team, he led the inter-comparison of four leading whole atmosphere models, and demonstrated that one of the major causes of model bias is the uncertainty associated with gravity wave parameterization. He was the chair of the Student Program at the Eighth FORMOSAT-3/COSMIC Data Users' Workshop, and is a co-chair of the International Association of Geomagnetism and Aeronomy Working Group II-D: "External Forcing of the Middle Atmosphere."

2.4 Distinguished Young Scientist – Honorable Mention Award – Dr. Xin Cheng

***Dr. Xin Cheng** from the School of Astronomy and Space Science in Nanjing University, China receives the SCOSTEP **Distinguished Young Scientist 2016 - Honorable Mention Award** for conducting original research on the origin and evolution of coronal mass ejections (CMEs), the key component of the solar-terrestrial relationship.*

Dr. Cheng's major contribution to the research on the origin and evolution of coronal mass ejections (CMEs) includes the discovery of a new coronal identity of the magnetic flux rope (MFR), a coherent and helical magnetic structure, which is believed to characterize the core of many CMEs.

Dr. Cheng has also investigated the initiation mechanism of CMEs, which is crucial for space weather forecast but very difficult to clarify. He has investigated the kinematic evolution of CMEs to uncover the early-phase acceleration of CMEs, and demonstrated the essential role of ideal instabilities in the impulsive acceleration of CMEs.

3. General Information about SCOSTEP

Information on SCOSTEP can be found at: http://www.yorku.ca/scostep/

The Scientific Secretary is the main point of contact for all matters concerning SCOSTEP.

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