



## **SCOSTEP Distinguished Scientist Award 2016 – Prof. Dr. Sami Khan Solanki**

*Prof. Sami Khan Solanki, Director of the Max Planck Institute for Solar System Research 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 presumable 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 ( $^{14}\text{C}$  and  $^{10}\text{Be}$ ) 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 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 Organising Committee member, he has contributed to the organisation 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 programmes within the SCOSTEP field: the DFG (Deutsche Forschungsgemeinschaft) priority programme 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.