International Alexander Chizhevsky Medal for space weather and space climate : Jiajia Liu

Dr. Liu obtained his PhD degree in June 2015 from the University of Science and Technology of China with honors. Up to now, he has published an impressive 31 peer-reviewed papers in top journals, including Nature Communications and Nature Physics. Out of those, he has led 13 peer-reviewed papers as the first or corresponding author.

Jiajia is receiving this medal in recognition of several accomplishments. He carried out research in a number of areas of solar and space physics. At very high standards, he combines complex physics behind various phenomena, like solar jets, MHD waves and coronal mass ejections, with the latest advanced mathematical and computer science techniques, including machine learning for forecasting space weather.

Dr. Liu has, for the first time, introduced the novel techniques of computer vision and machine learning into the area of CME arrival time prediction. By training machine learning algorithms with historical data, and applying advanced convolution neural networks on single observations, he achieved a significant progress in CME arrival time forecast, with an accuracy of less than 12 hours. Importantly, he created a free of charge user-friendly software in order to allow the scientific community to benefit from his recently implemented improved space weather forecasting approach.

Dr. Liu has been awarded with national honors already during his PhD. As an outstanding undergraduate student, his academic performance was ranked in the top 10 percent of students in their grade and major, and consequently has been awarded with the Chinese National Scholarship for Doctoral Students. Selected high-quality publications of Jiajia have been distinguished with national outstanding paper awards. As fourth in the world, one of his excellent works has been highlighted by the renowned American Astronomical Society. As a natural continuation of this successful path, Dr. Jiajia Liu is now awarded with the Alexander Chizhevsky Medal, in order to honor his early-career outstanding and innovative achievements in space weather research.

International Baron Marcel Nicolet Medal for space weather and space climate : Professor Delores Knipp

Delores Knipp is an outstanding ambassador for space weather, and has been a leader in the science, teaching, and dissemination of space weather research for decades. She has made major contributions to our understanding of the ionosphere and thermosphere and to the intimate relation between these two co-located domains. In parallel, Delores has also been developing and presenting space weather courses for undergraduate students, and mentoring numerous graduate students and post-docs. She takes mentoring very seriously.

Delores has recently completed a five-year term as Editor-in-Chief of the American Geophysical Union's Space Weather journal. During her term, she has expanded the international reach of the journal, creating an international editorial board and engaging with authors and reviewers from around the world. She also contributed to the wider space weather community in two other areas: opening up underused datasets, and research on historical space weather events.

She has worked tirelessly to revive relevant data acquired by space weather sensors on the US DMSP satellites – a challenging task to clean and verify data that contained important information on Poynting flux and electron precipitation, and making them available to users around the world. She created an important resource, one that has led to several discoveries and one that is a great example of the importance of data preservation in the space weather field.

Delores has undertaken studies of several historically large space weather events and encouraged and supported others around the world to do the same. This is an important area of study since it gives insights into what adverse space weather looks like, and its potential impacts on technology and on human society. Delores recently published papers on the 1967 and 1972 events, she looked beyond the space weather community by gaining important insights from discussions with users affected by those events, a timely collection of what we may call "living history". She has also encouraged other recent work on the major space weather events that occurred in 1770, 1859, 1909 and 1921.

In summary, Delores Knipp had made major contributions to the international space weather and space climate community, contributions that go well beyond her research achievements. She is outstanding educator who has reached out to other communities, and continues to do so. She has strengthened the community at both national and international levels, particularly through her recent leadership of Space Weather journal, but also through her wider work on the physics of space weather, on reviving important space weather datasets, and on the study of historically severe space weather events.

International Kristian Birkeland Medal for space weather and space climate Doctor Bruce Tadashi Tsurutani.

Dr. Bruce Tsurutani, is principal scientist at Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA.
Dr. Tsurutani is renowned in multiple research fields including space weather, nonlinear plasma waves, plasma instabilities and wave-particle interactions, auroral particle precipitation, dayside ionospheric physics, solar wind interactions with magnetosphere and ionosphere, geomagnetism. Among them, space weather has provoked his lifelong attention and dedication. He published around 700 papers peer reviewed journal.
In his Ph.D. thesis, the study results suggested that the main triggering mechanism of magnetospheric substorms is the southward turning of interplanetary magnetic field (IMF).
During 1974-79, Dr. Tsurutani found the post-midnight relativistic during substorms and evidence of power line stimulation by chorus waves.
In 1984 he revealed that although the IMF southward turning may trigger geomagnetic activity substorms, the substorms can be further intensified by heliospheric current sheet crossing the magnetosphere.
In 1987 Dr. Tsurutani found that High Intensity Long Duration (T > 2 days), and continuous aurora1 activity (HILDCAA) events are caused by outward (from the sun) propagating interplanetary Alfvén wave trains.
After studying major magnetic storms during the maximum of the 20^{th} solar cycle, Dr. Tsurutani found that quantitative predictions of storm intensities based on solar observations appear to be very difficult but that the extreme values of the southward interplanetary magnetic fields, rather than solar wind speeds, are the primary causes of great magnetic storms.
He soon found out that a possible mechanism for generating the intense interplanetary Bs, which is responsible for the subsequent intense magnetic storms, is the shock compression of preexisting southwardly- directed IMF Bz (Bs).
After studying a historical super storm that occurred in September 1859, he noted that the most intense magnetic storms are indeed related to intense solar flares, and that the two phenomena have a common cause: magnetic reconnection at the Sun. Dr. Tsurutani found that during an interplanetary/solar event, extremely complex magnetic storms can occur in the post-solar maximum phase as well.
He discovered the “superfountain effect” of the dayside ionospheric total electron content (TEC), a consequence of the “prompt penetration” of interplanetary/polar cap electric fields to the equatorial and near-equatorial ionosphere. He also explored the ionospheric effects of prompt penetration electric fields for a variety of interplanetary magnetic field directions. He categorized the positive- phase ionospheric storms that occur in the dayside (i.e., the superfountain), and negative-phase ionospheric storms that occur on the nightside (with a TEC reduction).
Later Dr. Tsurutani reported a different mechanism that also causes the dayside TEC enhancement; extreme EUV solar flares can result in extreme ionospheric effects, including a sudden, intense, and long-lasting ionospheric TEC enhancement in the dayside ionosphere, and may affect radio navigation and communications.