14th Quadrennial Solar-Terrestrial Physics Symposium (STP14)

York University, Toronto

July 9-13, 2018

Second Announcement

Abstract Deadline: February 15, 2018

Registration Deadline: April 15, 2018 (Early Bird)

Keynote Speakers: Irina Mironova (Russia), Larry Paxton (USA), David Kendall (Canada), Spiro Antiochos (USA)

There is only one month left for Abstract Submission. Please submit your abstracts to any of the following sessions. Details on travel, visa, accommodation, and venue can be found in: http://www.scostepevents.ca/ .

Sessions and Conveners

Session 1: Mass Chain (MC)

MC1.1 Origin, evolution, and Earth impact of coronal mass ejections

Committee
C. Rodger, K. Cho, K. Shiokawa, J. Bortnik, M. Temmer, V. Obridko, I. Mann

Lead Conveners
J. Zhang, S. Kanekal, V. Kuznetsov

Session Description
A coronal mass ejections (CME) is a large-scale energetic eruptive phenomena originating in the Sun's lower atmosphere. Carrying a large amount of kinetic and magnetic energy often in an organized flux rope structure, it bursts into the interplanetary space and interacts with the ambient solar wind. The CME may drive ahead a large-scale interplanetary shock, which in turn accelerates energetic particles permeating the heliosphere. Upon arriving at the Earth, the CME usually generates a cascade of physical effects in the geospace, collectively called space weather, i.e., geomagnetic storms including storm sudden commencement (SSC) and geomagnetically induced current (GIC) on the ground, development of ring current and energetic particles in the radiation belts. In this Session, we invite contributions that study the origin, evolution and Earth-impact effects of CMEs. These studies include, but not limited to, the following topics. What is the initiation mechanism of CMEs that concerns the pre-eruption magnetic structure, the role of magnetic flux rope and magnetic reconnection? How does a CME accelerate and expand in developing the flux-rope-shock complex? How does a CME propagate and evolve in the interplanetary space? How does the CME-driven interplanetary shock accelerate and inject energetic particles? What are the space weather effects of CME interaction with the

magnetosphere? How does the SSC associated with CME arrival cause GIC on the ground? How does the ring current energy and composition changes during geomagnetic storms? How do the radiation belt particles dropout and re-appear at various energy levels during the main and recovery phase of storms? Developing the capacity of predicting the time of arrival of CMEs and modeling CME's internal magnetic structure are also sought in this Session.

MC1.2 Origin, evolution, and Earth impact of high speed streams

Committee
K. Georgieva, S. Kanekal, C. Rodger, J. Bortnik, M. Temmer, J. Zhang, I. Mann

Lead Conveners
M. Temmer, V. N. Obridko

Session Description
Coronal holes are regions of reduced density and low temperature in the solar corona produced by quasi-open magnetic field lines enabling plasma to freely escape into IP space. They generate so-called high speed solar wind streams (HSS) with higher-than-average speeds up to ~800 km/s. The slow solar wind, formed above active regions, interacts with the fast wind and form stream interaction regions (SIRs) or, when persistent over several solar rotations, corotating interaction regions (CIRs). Together with sporadic fast flows of transient ejecta, such as CMEs, SIRs/CIRs shape the distribution of solar wind flow in the inner heliosphere. With this they permanently change the environmental conditions of near-Earth space and determine our space weather. We invite contributions about studies on CH evolution and related HSS/CIR/SIR signatures using in-situ measurements at multiple viewpoints as well remote sensing data from space-borne and ground-based instruments in multi-wavelength range (like He I 1083 nm, radio, white-light) and magnetic field information; interaction of solar wind structure with transient events (CMEs); geomagnetic disturbances and inner magnetosphere impact.

MC1.3 Origin, evolution, and Earth impact of energetic particles from solar, magnetospheric and galactic sources

Committee
K. Shiokawa, C. Rodger, S. Kanekal, B. Heber, I. Mann

Lead Conveners
B. Heber, S. Kanekal

Session Description
The radiation effects of energetic particles have not only severe implications for interplanetary manned space missions but can also cause fatal damage of satellites due to charging or radiation damage of electronic components. Although the intensity of galactic cosmic rays that have their origin outside the heliosphere varies by less than an order of magnitude over the solar cycle flux GCRs form the most energetic radiation component. Less energetic are solar energetic particles. Energetic electrons in the outer radiation belts have been known to increase by several order of magnitude for sustained periods of time and cause spacecraft damage via deep dielectric

discharge. Together with energetic particles of magnetospheric origin like those in the dynamic radiation belts these particles have their impact on the Earth' environment. We invite contributions that present modeling as well as observational results on the origin, evolution and impact of these radiation components.

Session 2: Electromagnetic Chain (EC)

EC2.1 Long-term solar variability (magnetism, total irradiance, and spectral irradiance) and its impact on geospace and Earth

Committee
P. Charbonneau, D. Nandi, D. Marsh, F-J Lübken, K. Georgieva, V. N. Obridko

Lead Conveners
K. Georgieva, P. Charbonneau

Session Description
The solar dynamo is the engine and dynamical driver of solar magnetic variability, including the prominent 11-yr activity cycle as well as its modulation on longer timescales. Proper physical understanding of the mechanisms driving this long timescale variability is thus needed in order to quantify the response of the geospace environment and Earth's upper atmosphere, and assess the relative impacts of natural versus anthropogenic factors in climate change. This session will focus on the long-term (from cycle-to-cycle to millennial and beyond) variability of solar magnetism, including grand minima and maxima of solar activity, total and spectral solar irradiance, solar wind modulation, the frequency and intensity of solar extreme events, and their impact on geomagnetic activity and long-term changes in the lower, middle and upper atmosphere, and in the ionosphere. Reports on theoretical, modeling and observational approaches on this topic are welcome.

EC2.2 Origin of solar flares and their impact on Earth's ionosphere/atmosphere

Committee
K. Shiokawa, K. Cho, M. Temmer, J. Zhang

Conveners
K. Cho, K. Shiokawa, D. Marsh, F.-J. Luebken, V. N. Obridko

Session Description
Solar flare is a sudden increase in solar X-ray and extreme ultraviolet (EUV) irradiance. Enhanced X-ray and extreme EUV irradiance during a solar flare causes the extra ionization at Earth's ionosphere and results in deleterious effect on radio wave communication and navigation. Since solar flares are a key topic to understand influence of the Sun on Earth's ionosphere and atmosphere, Interest in the effects of flares on the ionosphere has gradually

increased over the last few decades and extensive studies have been carried out. However, the fundamental process and origin of solar flares are still not well understood. This Session will focus on the origin of solar flares and their impacts on the changes in Earth's ionosphere and atmosphere. Reports on both modeling and observational approach on this topic is very welcome.

Session 3: Intra-Atmospheric Chain (IAC)

IAC3.1 Geospace response to variability of the lower atmosphere

Committee
T. Nakamura, K. Shiokawa, D. Marsh, W. Ward

Lead Conveners
K. Shiokawa, W. Ward

Session Description
Variations of plasma, electromagnetic field, and neutrals in geospace regions, particularly those in the ionosphere and thermosphere, are significantly affected by various inputs from the lower atmosphere. This session focuses on the geospace response to the variability of the lower atmosphere, including topics on the penetration of sound waves, gravity waves, tides, and planetary waves from the lower atmosphere to the thermosphere and ionosphere, and their connection to the inner and outer magnetosphere. The impact of longer term variability such as ENSO and the quasi-biennial oscillation which affect the upward propagating wave fluxes are also encouraged. Reports on both the modeling and observational approaches on this topic are very welcome.

IAC3.2 Trends in the entire atmosphere, including anthropogenic aspects

Committee
D. Marsh, F.-J. Lübken, T. Nakamura, K. Georgieva

Lead Conveners
D. Marsh, K. Georgieva

Session Description
This session focuses on numerical and observational studies of changes in the entire atmosphere (troposphere to exosphere) that occur on timescales from a decade to centuries. Of interest are studies that focus on the detection and attribution of atmospheric variability that is of solar and anthropogenic origin, e.g., solar cycle changes in irradiance and energetic particles and increases in greenhouse gases and ozone depleting substances. Submissions are particularly encouraged that examine how the response to these drivers of long-term variability in one atmospheric layer propagates upwards or downwards to other layers.

IAC3.3 Regional, hemispheric and inter-hemispheric couplings and transport in the atmosphere

Committee
F.-J. Lübken, T. Nakamura, K. Shiokawa, W. Ward

Lead Conveners
F.-J. Lübken, T. Nakamura

Session Description
Variations of plasma, electromagnetic field, and neutrals in geospace regions, particularly those in the ionosphere and thermosphere, are significantly affected by various inputs from the lower atmosphere. This session focuses on the geospace response to the variability of the lower atmosphere, including topics on the penetration of sound waves, gravity waves, tides, and planetary waves from the lower atmosphere to the thermosphere and ionosphere, and their connection to the inner and outer magnetosphere. Inter-hemispheric variations associated with seasons, the response associated with major dynamical events such as sudden stratospheric warmings and the impact of longer term variability such as ENSO and the quasi-biennial oscillation which affect the upward propagating wave fluxes are also encouraged. Reports on both the modeling and observational approaches on this topic are very welcome.

IAC3.4 Magnetosphere – Ionosphere – Thermosphere coupling in SC 24

Committee
Ian Mann, Kazuo Shiokawa, William Ward, Andrew Yau

Lead Conveners
A.W. Yau, I.R. Mann

Session Description
The transfer of mass and energy from the solar wind and magnetosphere to the ionosphere and thermosphere occurs primarily but not exclusively at high and mid latitudes. This transfer affects the entire geospace in one way or another, through a variety of physical processes coupling the magnetosphere, ionosphere and thermosphere (MIT) system which often exhibit strong variability in occurrence and behavior with the 11-year Solar Cycle (SC). At high latitudes, the impact of such processes is often seen in the form of disturbed electric fields, currents, electron densities, ion and electron temperatures, brightening aurora displays, ionospheric ion outflows, increase in small-scale plasma-density irregularities, and energetic particle precipitation, particularly during geomagnetic storm and substorm times. At mid and low latitudes, the impact is seen in the form of ring current intensification, stable auroral red arcs, storm-enhanced electron densities, sub-auroral polarization streams, sub-auroral electric fields and their penetration to equatorial latitudes, F3 layer strengthening, disturbance neutral winds and dynamo electric fields, plasma bubbles, and change in total electron contents during magnetic storms. The extensive satellite and ground-based observations in the current SC (SC24), which is the weakest SC in a century, provide an excellent opportunity for probing the behavior of MIT coupling

under the quietest solar conditions. We invite contributions of observation and modeling studies on the various aspects of MIT coupling in the context of SC24.

Session 4: Special Topics (ST)

ST4.1 Long-term Sun-Earth-Climate chain

Committee
P. Martens, D. Nandi, P. Charbonneau, D. Marsh

Conveners
P. Martens, D. Nandi

Session Description
Life has existed on planet Earth for over four billion years, so it must have originated fairly soon after Earth formed. Until a billion and a half years ago life consisted only of single cell organisms in bodies of water and shorelines. However, the radiation coming from the Sun was not very conducive to the development of life on Earth.

First of all, the initial luminosity of the Sun was only 70% of what it is now, linearly increasing in time to its current value. Climate models show that the Earth's oceans must have been completely frozen over for most of the four billion period: "Snowball Earth". Yet geological evidence points to a warmer climate on Earth in a distant past. This is known as the "Faint Young Sun Paradox", and researchers from various fields have come up with very different hypotheses for solving it.

Secondly, the young Sun was far more magnetically active than the current Sun, and hence X-rays, gamma rays, EUV, and UV radiation was probably orders of magnitude more intense than currently, and that without a protective Ozone layer for much of Earth's history. Hence, the DNA of all living organisms was under constant assault, certainly not a benign environment for the evolution of life. Still, life not only developed, it flourished and colonized the entire planet. Many hypotheses have been developed in very distinct fields (biology, geology, atmospheric science, astronomy) to resolve this double conundrum, but no completely satisfactory and complete theory has been developed yet.

In this session we aim to bring together experts in various fields to address the double paradox – not enough visible photons, too many high energy photons – with the goal of building a comprehensive multi-disciplinary understanding of the problem.

ST4.2 Space Weather

Committee
N. Nitta, C. Rodger, K. Shiokawa

Conveners
N. Nitta, K. Shiokawa

Session Description
Space weather represents short-term variations of conditions in the heliosphere that affect planets such as our own Earth. Interest in space weather has grown significantly in recent years as we get better informed of its possible impact on our highly technology-dependent society. Space weather is ultimately attributable to the Sun, whether the central role is played by transient phenomena such as solar flares and coronal mass ejections or by high-speed solar wind streams from coronal holes. These then drive processes in interplanetary space and the planet's atmosphere. We tend to expect big space weather events while solar activity is high. Interestingly, during the weak solar cycle 24, we witnessed a few extreme events, which may have been comparable to the so-called Carrington event. They could have caused disastrous effects on terrestrial assets if they had occurred days earlier and been directed to Earth. The primary purpose of this session is to discuss recent progress in our understanding and prediction capabilities of space weather, made possible by the availability of advanced coordinated data and the development of innovative theory and modeling. We particularly welcome studies of recent major space weather events such as those in September 2017.

ST4.3 Will Cycle 25 be special?

Committee
V. Obridko, I. Kitiashvili, A. Kosovichev, J. Javaraian, N. Kleeorin

Convener
V. N. Obridko

Session Description
Our symposium occurs in a very special period for the analysis of the solar activity. After a year or two, solar activity should fall to a minimum. This minimum between 24 and 25 cycles will allow a more accurate prediction of the height of the next maximum. It will be possible to use the most reliable forecast methods. The height of cycle 25 is of particular importance for the physics of the sun. If it is at least slightly above the 24 cycle, then we can say that there have been no violations of statistical regularities, and we more or less correctly describe the 11-year cycle over a time interval of the last 200 years. If it turns out to be at least a little lower than 24 cycles, this will mean the second consecutive violation of the Gnevyshev-Ohl rule, which may mean breaking the basic (previously found) regularities, possibly changing the sign of this rule. And, finally, if the 25th cycle is very low, this may mean the beginning of a new grand minimum, which we generally do not know the nature of and we do not know how to predict them. In recent years, the method of combining experimental data with dynamo theory has been intensively developing (the method of data assimilation). This method gives quite good results at relatively short time intervals (3-5 years). It is hoped that the period 2018-2010 will make it possible to use this method for a more accurate forecast of the 25th cycle.

ST4.4 New Missions (space, ground) for STP

Conveners
N. Gopalswamy, F.-J. Lübken

Session Description
This session involves new efforts around the world in building ground-based and space-based observing systems that provide data for solving problems in solar terrestrial physics. There are several new efforts to make use of cube-sats and small-sats to explore the solar-terrestrial to provide crucial data that fill current data gaps. There are efforts to deploy instruments at different viewpoints located off the Sun-Earth line (L5 and L4 Lagrange points) and above the ecliptics. There are new ground-based efforts to enhance the long-term and short-term data sets to make substantial progress in solar terrestrial physics. Papers are invited to deal with all aspects of new missions: concepts, missions, instruments, and data systems.

Scientific Organizing Committee: Nat Gopalswamy (Chair), Franz–Josef Lübken (Vice-Chair), Kyung-Suk Cho, Vladimir Kuznetsov, Mark Lester, Daniel Marsh, Takuji Nakamura, Craig Rodger, Annika Seppälä, Katya Georgieva, Kazuo Shiokawa, Jacob Bortnik, Paul Charbonneau, Donald Danskin, Ian Mann, Petrus Martens, Dibyendu Nandi, Vladimir Obridko, Manuela Temmer, William Ward, Andrew Yau, Jie Zhang, Yihua Yan, B. Heber, Nariaki Nitta, David Lario, and Shri Kanekal

Local Organizing Committee: Marianna Shepherd (Chair), Spiros Pagiatakis, James Whiteway, William Ward