



## **SCOSTEP Distinguished Scientist Award 2014 – Prof. Gordon Greeley Shepherd**

**Dr. Gordon Greeley Shepherd**, Distinguished Research Professor Emeritus of Earth and Atmospheric Science at York University, is the recipient of the **SCOSTEP Distinguished Scientist Award** for 2014. Prof. G. Shepherd's seminal accomplishments and sustained contributions in upper atmosphere physics, chemistry, energetics, and dynamics, have significantly impacted the field of solar-terrestrial research. To date he has published more than 260 refereed journal publications resulting in 4504 citations, 3454 without self-citation. This places him in the top 1% in his field, according to Thompson Reuters Essential Science Indicators, and quantifies the impact of his scholarly research. His extraordinary scientific accomplishments and qualifications for the SCOSTEP Distinguished Science Award are summarized below.

Gordon Shepherd received his Ph.D. in physics from the University of Toronto in 1956. The early part of his research career was at the University of Saskatchewan, applying newly developed interferometric spectroscopy techniques to studies of aurora and airglow. Gordon initially deployed ground based instruments to measure a host of phenomena, including mesospheric sodium concentrations, pulsating aurora, auroral proton velocities deduced from hydrogen Balmer beta emission, and Doppler temperatures within the aurora and airglow. He subsequently developed new versions of these instruments for rocket flights, which allowed the first ever in-situ measurement of the Balmer beta emission in a proton aurora and led to his role as Principal Investigator for the Red Line Photometer (RLP) on the second International Satellites for Ionospheric Studies (ISIS-II) satellite. Gordon moved to York University in 1969 and ISIS-II was launched in 1971. RLP successfully mapped daytime red aurora associated with the cusp, tropical red arcs, conjugate photoelectrons, and mid-latitude stable red auroral (SAR) arcs. Following the RLP cusp work, Gordon led a team to Cape Parry on the Arctic coastline, and launched rockets to make the first in-situ measurements of the daytime aurora. Prof. Shepherd has consistently pursued international collaborations with scientists from Asia, the United States and Europe. Gordon's visit to the Laboratoire Aimé Cotton in Paris in 1961 inspired the configuration of a ground based instrument, the Wide Angle Michelson Interferometer (WAMI) for measuring Doppler temperatures in the aurora and airglow. Gordon subsequently demonstrated the crucially important step of extending WAMI to include wind observations from the Doppler shifts by making those measurements.

In 1987 Gordon was co-investigator in the establishment of the Institute for Space and Terrestrial Science (ISTS), a Centre of Excellence based at York University. ISTS became the Centre for Research in Earth and Space Technologies (CRESTech), and Gordon became the Director of the Solar Terrestrial Physics Laboratory within that centre. He was also Director of the Centre for Research in Earth and Space Science at York University from 1996 to 2009. During this period Gordon and his colleagues developed a ground-based Spectral Airglow Temperature Imager (SATI) and provided instruments to Japan, China, Korea, Kazakhstan, Bulgaria, Spain, as well as Canada. Perhaps the most successful SATI was one of two Korean instruments operated collaboratively at Resolute Bay, yielding eight years of Arctic mesospheric temperatures and establishing their relationship to stratospheric sudden warmings. Gordon subsequently evolved the WAMI instrument into the Wind Imaging Interferometer (WINDII), launched on NASA's Upper Atmosphere Research Satellite (UARS) in 1991. Because WINDII measured winds from airglow during both day and night, it definitively characterized the diurnal tide at the equator and demonstrated that it was much larger than previously thought. WINDII

also measured atomic oxygen airglow and concentrations, showing a systematic relationship between airglow altitude and emission rate with higher airglow emission peaking at lower altitude. This relationship was interpreted as a dynamical influence on the airglow (i.e., downward advection of atomic oxygen from above increasing the emission rate), and shown to be a dominant influence on airglow variability. Gordon and the WINDII Science team also investigated many other phenomena with WINDII, including wind enhancements during geomagnetic storms, polar mesospheric clouds, the quasi two-day wave, the springtime transition, longitudinal wind variations, tropical arcs, and the influence of the Sun on airglow and atomic oxygen concentrations. Gordon's role as the principal investigator of WINDII involved the leadership of a large team of French and Canadian scientists, and work with CNES, CSA and NASA personnel. Although it has been more than twenty years since WINDII was launched, its capability has yet to be reproduced. Gordon's ongoing research efforts include investigations of non-migrating tides, polar spirals in winds that appear to be related to traveling ionospheric disturbances (TIDs), airglow "bright nights", solar cycle variability, thermospheric atomic oxygen concentrations, the  $O^+$  airglow, and hydroxyl rotational temperatures. Gordon proposed the SCOSTEP Planetary Scale Mesopause Observing System (PSMOS) project and co-chaired PSMOS from 1997 to 2002. PSMOS involved more than 100 scientists from 21 countries. The basis of the PSMOS project was the large and then unresolved longitudinal variations observed by WINDII, along with radars and small instruments like SATI. By all measures PSMOS was a success. Under its auspices the scientific community conducted global ground-based measurement campaigns, and reported their results at international symposia and in a 2010 special issue on the Ionosphere/Thermosphere in the Journal of Atmospheric and Solar-Terrestrial Physics. Gordon's SCOSTEP contributions also include his six-year term on the Bureau from 2004 to 2010. During roughly the same period he was a member of the COSPAR Bureau and was chair of the Executive Committee that hosted the 2008 Scientific Assembly in Montreal.

Gordon Shepherd is an outstanding scientist who has made seminal contributions to our understanding of the ionosphere-thermosphere system through the development of innovative instruments and the subsequent analysis of their observations over the course of a research career that is approaching 60 years duration. He is a scientific leader and innovator, and a modest person of integrity.