Meteoritics & Planetary Science 37, 899–900 (2002)
Available online at http://www.uark.edu/meteor

From the Editors

And just when you thought that the Leonid meteor storm held no more surprises: The 2001 storm

The 2002 International Science Symposium on Leonid Meteor Storms, including the 3rd Leonid Multi-Instrument Aircraft Campaign (MAC) Workshop (Rietmeijer, 1999, 2000), was held at the National Museum of Emerging Science and Innovation in Tokyo, May 2–5. There were 120 participants, including many Japanese amateur astronomers and high school students. At this three-day symposium 70 oral and poster papers were presented on the ongoing Leonid meteor storm. The 2001 storm activity had two peaks when the Earth intersected different trails of debris released from the parent in comet 55P/Tempel–Tuttle. The first peak from solid materials released in 1767 was visible across the western U.S. with a peak rate of 1300 meteors per hour. The second peak of debris released during the 1699 and 1866 returns of the comet occurred across the western Pacific and had an even higher peak rate of 3000 meteors per hour. The ongoing Leonid campaigns confirm to old adage that things will only happen to those who are prepared. The finding of a bow shock-like feature for a Leonid meteor at 113 km is both exciting and hard to explain even if it turns out to be a rare phenomenon in the rarified atmosphere at this altitude.

Today's observational tools are so sophisticated that subtle yet important features can be studied, such as the occurrence of 1–2 s meteor "bursts" within the storm that reveal detailed structure within a dust trail, for example, meteoroid dispersion within the dust "tube" of aging trails perpendicular to the orbit. This information will allow fine tuning of the predictions of future Leonid meteor fluxes, which might be relevant to satellite operators. Also, the occurrences of non-random groupings of meteors as a result of on-orbit meteoroid fragmentation after a recent release from the comet prior to dispersal of their orbits with a trail. This raises the possibility of space weathering of probably highly volatile "glue" in dust rejected from the comet.

In an island nation where the weather doesn't always cooperate with visual astronomy, radio meteor observations are popular. These observations are not effected by the elevation of the storm radiant above the horizon. This technique may thus offer a better accounting of the meteor flux, including minor contributions from older trails embedded within the Leonid storm. Comets are believed to have supplied the early Earth with organic species and finding CN, C_2, C_3 and NH_2 signatures in Leonid meteors has considerable relevance to astrobiology. How different are individual comets? The latest data put the CN abundance in Leonid meteors at a factor of 10 below the N abundance in comet Halley's complex organic materials. Detection of an OH signal at 310 nm in a meteor at 100 km altitude might indicate the presence of hydrated silicates in comet 55P/Tempel–Tuttle. It could imply that some fraction of the hydrated interplanetary dust particles (IDPs) will be cometary debris. The Leonids are known for persistent trains that may last for many minutes and we now know that these trains evolve in three phases. That is, (1) the afterglow with rapid decay in the intensity of atomic emission lines, (2) a luminous phase dominated by atomic emission lines including high excitation Mg lines, and (3) a yellow chemoluminescent continuum of molecular recombination (*e.g.*, NO_2, FeO and CaO). The final phase might be the prelude to the formation of meteoric dust that still remains elusive to collection efforts.

Readers of this journal may be interested to learn that the spectroscopic data for meteor trails can be reduced into elemental abundances from which meteor bulk compositions can be derived as a function of meteoroid mass. Also, the emission behavior for individual elements and combinations of elements (*e.g.*, Mg and Na) offers an opportunity to assign mineral phases to the constituents in these meteoroids based on those found in aggregate and clusters IDPs. In this way, meteor observations are the closest thing to study the similarity and diversity among comets. The observational data from the international Leonid campaigns are turning an esoteric interest into a mainstream subdiscipline of meteoritics. After all, shower and storm meteors are cometary debris that could not survive as IDPs. Yet, they extend the range of information on dust accretion and evolution preserved in icy protoplanets.

Maybe the most significant event during this workshop occurred one afternoon when the professionals cleared the stage for middle and high school pupils who gave very impressive poster presentations. Hundreds of young people and amateur astronomers reported their observations. Leonid meteors have grabbed the attention of a nation, where the future generation of space scientists has already shown its face. The future of meteor science is bright. In fact so bright that, although the number of meteors over the U.S. expected during the November 2002 Leonid storm will exceed those seen last year, only the brightest meteors and fireballs from centimeter-sized fragments will be visible in the face of a full Moon. Details on the Leonid storm are posted on the worldwide web at http://leonid.arc.nasa.gov, including a calculator to find out how many meteors to expect at your own location.

Frans J. M. Rietmeijer
Department of Earth and Planetary Sciences
The University of New Mexico
Albuquerque, New Mexico 87131-1116, USA

REFERENCES

RIETMEIJER F. J. M. (1999) Leonid MAC Workshop 1999, April 12–15. *Meteorit. Planet. Sci.* **34**, 495.

RIETMEIJER F. J. M. (2000) Fire in the Sky: The 1999 Leonid Multi-instrument Aircraft Campaign (MAC). *Meteorit. Planet. Sci.* **35**, 647.