

30 Years of H_3^+ Planetary Astronomy

Steve Miller

Department of Science and Technology Studies / Physics and Astronomy, University College London, Gower Street, London WC1E 6BT, United Kingdom (s.miller@ucl.ac.uk)

Abstract

On September 21, 1988, a team of French, Korean and Canadian astronomers made their way to the summit of Mauna Kea in Hawai'i to make use of the Canada-France-Hawai'i Telescope to observe the powerful aurorae of Jupiter. They were looking for infrared emission at 2.122 microns from the H_2 $v=1 \rightarrow 0$ S(1) quadrupole line, using the telescope's high-spectral resolution Fourier-transform spectrometer. That line was clearly observed.

But alongside the H_2 line was a slew of other, equally bright if not brighter lines, that could not be immediately identified. A worldwide collaboration – including the Molecular Physics Group at UCL – showed that the lines were from the H_3^+ molecular ion, the first time this fundamental species had been seen outside of the laboratory. This talk will outline the use that astronomers have made of H_3^+ emissions from Jupiter, Saturn and Uranus over the last 30 years, including:

1. Probing physical conditions in the upper atmospheres of these planets;
2. Exploring the dynamics of thermosphere-ionosphere-magnetosphere coupling;
3. Illuminating interactions between planetary magnetospheres and solar wind conditions the local space environment;
4. Helping us to understand measurements from ground-based observatories and space missions such as Galileo, Hubble, Cassini and JUNO.