Geophysical Research Abstracts
Vol. 12, EGU2010-2426, 2010
EGU General Assembly 2010

Infrared Emission Spectroscopy of Hot Methane and Hot Ammonia

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In 1995 Mayer and Queloz discovered a “hot Jupiter” orbiting around the star 51 Pegasi using the radial velocity Doppler technique. Since then research on extrasolar planets (exoplanets) has expanded vigorously, and hundreds exoplanets (see http://exoplanet.eu/) are now known. The observation of transiting exoplanets has allowed the spectroscopic detection of methane and water on hot Jupiters. These detections are based on model atmospheres that use suitable molecular opacities. For methane these molecular opacities are usually based on lines from the HITRAN database and from experimental data on hot methane published by Nassar and Bernath [JQSRT 82, 279 (2003)]. Very recently we have started a new set of laboratory observations of hot methane in the mid infrared covering a wide range of temperatures.
Although ammonia has not yet been detected in exoplanets, it is prominent in T-type brown dwarfs. Brown dwarfs are more massive than hot Jupiters, but the surface temperatures and chemical compositions are similar. We have recorded an extensive set of hot ammonia spectra from 850-7000 cm-1 for the temperature 600-1600 K range in 100 K increments. We will give a progress report on our new measurements and analysis methods for methane and ammonia. Our aim is to provide empirical linelists for use in simulating the spectra of exoplanets and brown dwarfs, and for the validation and improvement of ab initio calculations.