Molecular Line and Continuum Opacities for Modeling of Extrasolar Giant Planet and Cool Stellar Atmospheres

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Accurate simulations of spectra of Extrasolar Giant Planets (EGPs) and cool stars can be obtained through the use of sophisticated modeling programs, such as the PHOENIX code, which require high quality opacity data. The atmospheres of EGPs and cool stars consist largely of neutral, molecular constituents and thus molecular line and continuum opacities are needed to model the complicated radiative transfer problem.

In this work, our progress on the calculation of opacities resulting from the presence of three molecules, MgH, FeH, and LiCl, will be described. For MgH all bound-bound oscillator strengths between rotational and vibrational levels of the X, A, and B' electronic states have been computed. In addition, photodissociation cross sections for $B' \leftarrow X$ and $A \leftarrow X$ transitions have been obtained. Using the PHOENIX stellar atmosphere code, we have calculated synthetic spectra for an M-dwarf test model – both with and without the MgH continuum opacity. It is shown that as much as a 60% decrease in the transmitted photon flux between 3000 and 3500 Å may be observed when the MgH photodissociation process is included.

For the FeH and LiCl molecules, calculations of the relevant potential curves and dipole moment functions are underway. For the alkali halides, interesting resonance structure exists near threshold for photodissociation which can be described by an interaction of two potential curves. These resonances may be a significant opacity source.

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