New Mean-Opacity Tables for Probing Stable Stratification in Giant Planets

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Interior models of giant planets traditionally assume convection as the dominant heat transport mechanism in the molecular hydrogen envelope. However, several observations of Jupiter are challenging to explain under this assumption, including the measured abundances of CO and water in the atmosphere, as well as the depth of the zonal winds. A stable layer located around the kilobar level has been proposed to reconcile these observations, an idea that has gained more support with recent Juno measurements of alkali metals, which suggest a depletion in the deep atmosphere. While the presence of a stable layer around the kilobar level appears promising, the degree of alkali depletion required to sustain it remains unclear. In this presentation, I will introduce new mean opacity tables to determine the specific atmospheric compositions that can give rise to stable stratification in the outer envelopes of Jupiter, Saturn, and giant planets in general. These tables extend to higher pressures than those commonly used, making them particularly relevant for modeling planetary interiors and deep atmospheres. I will highlight the key opacity sources that control the presence of stable stratification in the outer envelopes of gas giants and point to species with missing or incomplete opacity data that may also play a significant role.