Monochromatic Molecular Absorption Coefficients for Use in Calculations of Stellar Opacity

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In order to fully understand stellar structure, it is necessary to know the opacity, as it influences the behavior of radiative transfer within the stellar interior. Opacity plays an important role in the onset of convection as well as driving stellar winds in cool stars. Opacity is the interaction of light with the surrounding medium, with major contributors being atoms, molecules and grains. Tables of average opacity values are highly dependent on the composition and if any values are altered, a completely new set of tables must be recalculated.

Using molecular line lists, a computer program was written to calculate the bound-bound transition cross-section absorption coefficients for eight different molecular species, including C_2, CH, CN, CO, C_2H_2, HCN, H_2O and TiO. Molecular line lists, like H_2O, consist of hundreds of millions of lines of data that slow down the process of calculation. Since the frequency specific opacity is dependent on temperature, the molecular absorption coefficients must be calculated for each and every temperature. This project computed cross-sections computed for a range of temperatures, log T = 2.8 - 4.0. Molecules were examined thoroughly at log T = 3.0. This research allows for an update in mean opacity tables based upon each molecular species and its abundance. This would provide necessary improvements in the computation of mean opacity tables used in stellar interior models.