

## **The Calculation of Atomic and Molecular Opacities for Astrophysical Applications**

*Richard Freedman,<sup>1</sup> Seti Institute*

In order to properly model and study the emergent spectra of a variety of astronomical objects it is necessary to adequately model the opacity of their atmospheres. The objects of interest to our group span a range of temperatures from very cold solar system objects to the lower temperature limits of stellar atmospheres. There is also a large range in pressures from fractions of a millibar to hundreds of bars. An added complication is that, unlike the typical stellar atmosphere that is predominantly neutral or ionized hydrogen and helium, these objects have atmospheres that are mainly molecular hydrogen and helium. In some cases involving hypothetical rocky planets that have suffered giant impacts there may be high concentrations of water (steam) or other volatiles. This creates problems for properly defining the line broadening parameters and even the line shape itself.

I will emphasize the need for better data and discuss some of the many challenges including getting line widths for species and broadeners that are not usually studied either in the lab or through computational simulations. I will also point out what will be needed as the resolution of astronomical observations improves in the future.

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<sup>1</sup>Richard.S.Freedman@nasa.gov