

Astrochemistry

Eric Herbst*

2 January 2006

Abstract

In this talk, I will emphasize some current needs of astrochemists for laboratory data. The data are urgently required both to detect molecules in assorted regions and to produce robust models of these regions. Three areas of laboratory-based research are particularly crucial and yet are not being studied in the United States: (i) reactions more complex than the formation of molecular hydrogen on interstellar grain analogs (or actual dust particles) at low temperatures, (ii) molecular spectroscopy in the THz (far-infrared) region of the electromagnetic spectrum, and (iii) gas-phase kinetics of reactions leading to simple and complex molecules. Reactions on cold granular surfaces are known to lead to species as large as methanol, yet the few that have been studied in any detail have been measured in Japanese laboratories. Molecular spectroscopy at THz frequencies will be needed to make sense out of the data to come from SOFIA and the Herschel telescope, yet currently only one laboratory is well-known for such measurements, and it is located in Germany. Finally, although ion-molecule reactions seem to explain, at least semi-quantitatively, much of the chemistry occurring in cold interstellar clouds, the far more complex gas-phase chemistry that occurs near star-forming regions in so-called hot cores and hot-corinos has not been studied with the completeness that is required. Moreover, there are even large gaps in our knowledge of low-temperature chemistry in the gas phase, some quite serious. Without solid knowledge of many unstudied but key reactions, both in the gas and on grains, astrochemists will not be in position to keep up with the large amount of new information expected to come from the next generation of telescopes.

*Ohio State University