PROGRESS IN THE DEVELOPMENT OF AN INFRARED ION BEAM SPECTROMETER

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Spectroscopic analysis of molecular ions is generally performed using a plasma discharge to produce the ion of interest. However, spectroscopy of the ions is complicated by the high temperatures and abundance of neutrals found in a plasma. The technique of velocity modulation has been effective in selectively measuring the spectra of ions while discriminating against the spectra of the considerably more abundant neutral molecules, but it has only been applied to fairly high temperature plasmas. Supersonic expansions have been profitably used to cool molecular ions to low temperatures, but they have not been used in combination with an ion-selective technique. We are aiming to develop an instrument which can provide both cold ions and effective separation of ions from neutrals. Specifically, we are improving the "direct laser absorption spectroscopy in a fast ion beam" technique developed in the Saykally group[a]. Our instrument will produce rotationally cold ions in a supersonic discharge source, then accelerate and manipulate them with ion optics. This ion beam will be steered into a field-free drift region, which will separate it from neutrals and make it collinear with a high finesse cavity to be probed with continuous wave cavity ringdown spectroscopy (cw-CRDS). This instrument, which we call SCRIBES (Sensitive Cooled Resolved Ion Beam Spectroscopy), will have the additional advantages of a sub-Doppler line width and mass-dependent Doppler splitting. Additionally, a time of flight mass spectrometer at the end of the apparatus will identify the species in the ion beam.

We will report the progress that has been made in maximizing the ion current in the drift region, including progress in source design. We will also introduce the second generation instrument. Improvements over the previous design will be discussed, as well as advancements in the characterization and optimization of the instrument.

[a] J. V. Coe, J. C. Owrutsky, E. R. Keim, N. V. Agman, D. C. Hovde, and R.J. Saykally *J. Chem. Phys.* **90**, 3893 1989.