DEVELOPMENT OF A SUBMILLIMETER MULTIPASS SPECTROMETER FOR THE STUDY OF MOLECULAR IONS

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We have developed a multipass spectrometer for the submillimeter spectral region that is being used to study molecular ions through gas phase spectroscopy. The optical configuration is based on the design of Perry and coworkers that was implemented in the optical regime. To our knowledge, this is the first implementation of this optical configuration at long wavelengths. The setup involves two nearly concentric spherical mirrors that focus the multiple beam passes into a small area, or "waist", in the middle of the sample chamber. A supersonic molecular beam is coupled to the setup so that the molecular beam crosses the optical path at the waist. Initial studies have focused on neutral test molecules to probe the physical properties of the molecular beam under various arrangements of the molecular source relative to the optical path. Current studies focus on coupling a plasma discharge source to the setup to enable the study of molecular ions. Here we present the design of this instrument, compare the spectrometer capabilities to a traditional single pass spectrometer, and discuss the results of initial spectroscopic studies.