DEVELOPMENT OF AN EXTERNAL CAVITY QUANTUM CASCADE LASER SPECTROMETER FOR HIGH-RESOLUTION SPECTROSCOPY OF MOLECULAR IONS

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Quantum cascade lasers (QCLs) have proven to be valuable tools for performing high-resolution infrared spectroscopy because of their high output powers and availability throughout the mid-infrared region of the electromagnetic spectrum. Despite their usefulness, typical QCLs can only be frequency tuned within a narrow window, requiring a specific laser to be used for measuring a specific molecular target. Recent advances in QCL technology have improved the tuning range of QCLs by creating lasers with broader gain profiles which can be used in an external cavity setup to produce widely-tunable, single-mode infrared radiation. In collaboration with the Wysocki research group at Princeton, we are developing a high-resolution infrared spectrometer based on an external cavity QCL (EC-QCL) system, which will allow us to perform spectroscopy from $\sim$1120 – 1250 cm^{-1}. We will present details of the development of the instrument, as well as preliminary spectroscopic results using the EC-QCL system. We will also outline future work we plan to perform with this spectrometer, particularly high-resolution spectroscopy of molecular ions.