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MHz Resolution Imaging Spectroscopy

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Velocity Mapped Ion Imaging has been used for the measurement of the velocity of molecules with resolution down to 1 meter per second. Because of this high velocity resolution one can use this technique to measure spectroscopic features with 1 MHz resolution. We demonstrate this ability on Kr atoms. A thermal distribution of Kr atoms is present in our Ion Imaging apparatus, we will use a three-photon scheme to ionize the Kr atoms, with one of the photon steps being supplied by a high resolution CW laser. By observing the portion of the Doppler width that is ionized by this combination of lasers one can determine the absolute frequency of the laser relative to the line center of the Kr transition, the power broadening associated with the cycling of the Kr atoms with the CW laser, the power broadening associated with the ionization laser and observe Zeeman splittings in the Doppler width of the Kr atom transition. The ability to visualize the photo-physics of the ionization process gives demonstrates how we can use this technique as a molecular wave meter.