

High Resolution Pulsed Field Ionization Multi-photon Spectroscopy Using Synchrotron Radiation and Near-infrared Laser

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We have developed a pulsed field ionization scheme (PFI) for high resolution two-color spectroscopy using undulator synchrotron radiation and an OPO near-infrared laser at NSRRC. By employing a quadrupole mass spectrometer (QMS), we show that ion produced by the PFI can be cleanly separated from prompt background photoions. A near complete suppression of prompt ions was achieved in PFI measurements by gating the ion peak through the QMS, as indicated by monitoring background ion counts at the Ne autoionizing Rydberg

peak, which is adjacent to the $\text{Ne}^+(^2P_{3/2})$ PFI band. This comparison indicates that the PFI scheme is significantly more effective in suppressing the background. In addition to attaining a high PFI transmission, a major advantage of the scheme is that it allows the use of a smaller pulsed electric field and thus results in a higher instrumental resolution. We have demonstrated instrumental resolutions of 0.15 cm^{-1} full width at half maximum (FWHM) and 0.2 cm^{-1} FWHM in the PFI bands for He^+ at 24.585 eV.