5. Time-resolved Raman spectroscopy for in situ planetary mineralogy

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A review. Planetary mineralogy can be revealed through a variety of remote sensing and in situ investigations that precede any plans for eventual sample return. We briefly review those techniques and focus on the capabilities for on-surface in situ examn. of Mars, Venus, the Moon, asteroids, and other bodies. Over the past decade, Raman spectroscopy has continued to develop as a prime candidate for the next generation of in situ planetary instruments, as it provides definitive structural and compositional information of minerals in their natural geol. context. Traditional continuous-wave Raman spectroscopy using a green laser suffers from fluorescence interference, which can be large (sometimes satg. the detector), particularly in altered minerals, which are of the greatest geophys. interest. Taking advantage of the fact that fluorescence occurs at a later time than the instantaneous Raman signal, we have developed a time-resolved Raman spectrometer that uses a streak camera and pulsed miniature microchip laser to provide picosecond time resoln. Our ability to observe the complete time evolution of Raman and fluorescence spectra in minerals makes this technique ideal for exploration of diverse planetary environments, some of which are expected to contain strong, if not overwhelming, fluorescence signatures. We discuss performance capability and present time-resolved pulsed Raman spectra collected from several highly fluorescent and Mars-relevant minerals. In particular, we have found that conventional Raman spectra from fine grained clays, sulfates, and phosphates exhibited large fluorescent signatures, but high quality spectra could be obtained using our time-resolved approach.