# INFRARED LIGHT GENERATION BY STIMULATED RAMAN SCATTERING OF SOLID PARAHYDROGEN

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One of the remarkable features of solid parahydrogen is its extremely narrow spectral linewidth. For example, the $Q_1(0)$ Raman transition of solid parahydrogen has a linewidth of only 7 MHz (HWHM).[a] The sharp linewidth is due to the rigorousness of the exciton momentum selection rule $\Delta k = 0$ in the crystal. Recently, noticeable properties of solid hydrogen as a Raman medium have been reported by Hakuta et al.[b] From a spectroscopic point of view, these results clearly indicate that solid parahydrogen is a useful medium for Raman shifter. Here, we report a preliminary result of infrared light generation by stilumated Raman scattering of solid parahydrogen. In VIS to UV region, more than 30 % conversion efficiency for the first Stokes was obtained in solid parahydrogen with nanosecond laser pulses. However, since the gain factor is inversely proportional to the wavelength, the conversion efficiency reduces drastically in IR region. Despite the low gain, enough power for absorption spectroscopy could be obtained in mid-infrared region. To demonstrate the applicability, we have generated 5 $\mu m$ radiation by introducing 1.6 $\mu m$ pulses from a nanosecond OPA laser in solid hydrogen. The $\nu_3$ vibration-rotation transition of $CD_4$ molecule was successfully observed with the output of the Raman shifter.

[a] T. Momose, D. P. Weliky and T. Oka *J. Mol. Spectrosco.* **153**, 760 (1992).

[b] K. Hakuta, M. Suzuki, M. Katsuragawa, and J. Z. Li, *Phys. Rev. Lett.* **79**, 209 (1997); M. Katsuragawa, and K. Hakuta, *Opt. Lett.* **25**, 177 (2000).