DEVELOPING CONTINUOUS-WAVE RAMAN LASERS USING SOLID PARA-HYDROGEN AND BARIUM NITRATE FOR MOLECULAR SPECTROSCOPY APPLICATIONS

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Many interesting molecular targets have vibrational transitions between 5 and 10 μm. However, widely tunable continuous-wave laser sources in this region are extremely rare. One possible solution to this situation is with continuous-wave Raman lasers. We will present our recent work toward the construction of two continuous-wave Raman lasers: one using solid *para*-hydrogen as the Raman shifting medium, and the other using barium nitrate. Solid *para*-hydrogen is a promising medium for a continuous-wave Raman laser because of its high Raman gain coefficient (18 cm/MW, almost 400 times higher than any room-temperature crystal), wide spectral transmission window (transparent from $\sim$100 nm to $\sim$30 μm), its nature as a "quantum crystal," and its large Raman shift (4150 cm^{-1} in the solid). We will also describe our more recent work designing and constructing a continuous-wave Raman laser in barium nitrate. Barium nitrate has the advantage of being the room-temperature crystal with the highest Raman gain coefficient, as well as being highly transparent from 350 to 1800 nm. Barium nitrate has been used as a continuous-wave Raman shifter for several years. Our recent work builds upon this foundation, combining lessons learned from our work with solid *para*-hydrogen. Our design is the first barium nitrate Raman laser using an actively-locked, doubly-resonant laser cavity. This holds the promise of requiring much lower threshold pump powers than previous setups. We will discuss some of the details in designing and building these lasers. Finally, we will report on the current state of our projects as well as anticipated future work.