OBSERVATION OF VIBRATIONALLY EXCITED STATES OF SiC_2 BY STIMULATED EMISSION PUMPING

SEDERRA D. ROSS, *Department of Chemistry, University of Massachusetts Boston, Boston, Massachusetts, United States*; KELVIN LEE, *Radio and Geoastronomy Division, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA*; JONATHAN FLORES, *Department of Chemistry, University of Massachusetts Boston, Boston, Massachusetts, United States*; MICHAEL C McCARTHY, *Atomic and Molecular Physics, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA*; NEIL J. REILLY, *Department of Chemistry, University of Massachusetts Boston, Boston, Massachusetts, United States*.

Recent observations of the evolved carbon star IRC+10216 with unprecedented high angular resolution have revealed a plethora of unassigned (U) rovibrational lines associated with the dust formation zone. Because SiC_2 is a known, abundant molecular constituent of this region, it is reasonable to posit that some fraction of the observed U lines arise from vibrationally excited levels of SiC_2 that are populated at elevated temperatures. At present, the radio band laboratory data that would permit testing of this hypothesis are largely absent: *ab initio* prediction of relevant spectroscopic parameters for SiC_2 has proved particularly challenging, and its excited vibrational levels are insufficiently populated in supersonic jet sources. However, the electronic transition responsible for the well-known blue-green Merrill-Sanford bands of SiC_2 admits Franck-Condon access to vibrational levels at least 4000 K above ground, inviting the application of stimulated emission pumping (SEP) for the observation of vibrationally excited states. SiC_2 has been efficiently generated in a jet-cooled discharge of silane and acetylene, optically pumped via the M-S bands, and fluorescence depletion SEP spectra observed for dump transitions terminating in a variety of excited vibrational levels of the ground electronic state. For known transitions within $1\nu_3$ and $2\nu_3$ (the pinwheel mode), our measurements are in generally excellent agreement (a factor of at least 5 smaller than the dump laser linewidth) with previous observations, giving us good faith in our experimental procedure; rotational analyses of previously unobserved transitions of all three vibrational modes are on-going at the time of writing, and will be discussed.