OPTICAL SPECTROSCOPY OF SILICON-CARBON CLUSTERS: Si_2C and Si_3C

NEIL J. REILLY, DAMIAN L. KOKKIN, MICHAEL C. McCARTHY, and PATRICK THADDEUS, *Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138, and School of Engineering & Applied Sciences, Harvard University, 29 Oxford St., Cambridge, MA 02138.*

We report the first measurement of an electronic spectrum of Si_2C, observed in a jet-cooled discharge through silane, acetylene and argon, in the $380 - 410$ nm wavelength range. While Si_2C is a highly plausible astronomical molecule, searches for its rotational transitions in the laboratory and in space are impractical at present - *ab initio* predictions of the rotational constants of this slightly bent species have yet to performed to within the required accuracy. By analogy with SiC_2, the carrier of the well-known Merrill-Sanford bands, electronic spectroscopy may provide estimates of its rotational constants and structure, thereby constraining searches for its millimeter-wave transitions. Our experiments suggest that the electronic transition has a large oscillator strength and a significant fluorescence quantum yield, making it a good candidate for optical detection in space, particularly in those carbon stars where SiC_2 is known to be abundant. As part of a more general effort to measure the electronic spectra of small silicon-carbon clusters, several examples of which have been identified in space by radio-astronomy, we present a spectrum of Si_3C with a much higher S/N ratio than has been previously reported, and which is now in excellent agreement with theory.