A SEARCH FOR LIGHT HYDRIDES IN THE ENVELOPES OF EVOLVED STARS

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The circumstellar envelopes of asymptotic giant branch (AGB) and red supergiant (RSG) stars are known for their unique chemistry and efficient production of dust grains. Though dust grain composition and behavior at micron-size is well-studied in the ISM, the chemical processes leading to their formation are poorly understood from an observational lens. Thus, characterizing the reservoir of gas-phase molecules in the "Dust Production Zones" of evolved stellar envelopes (5–20 R*) is crucial to understanding the process of grain condensation. Thermochemical equilibrium models predict that a variety of light hydrides (XH) are abundant in these regions; however, only three such species have been observed in CSEs to-date (HCl, HF, and OH). Using SOFIA's GREAT receiver, we conducted a search for the diatomic hydrides SiH and PH toward two well-studied circumstellar envelopes: IRC+10216 and VY CMa. We present spectra for these objects ranging from 600 GHz to 1.5 THz, where most ro-vibrational emission comes from highly excited molecules near the stellar photosphere. Neither SiH nor PH were detected in these envelopes, likely owing to their weak dipole moments and severe beam dilution expected from molecules in the inner envelope. We calculated upper limit abundances for SiH and PH in IRC+10216 and VY CMa and discuss their implications for equilibrium chemistry and dust grain formation theories in these important astronomical laboratories.