A SEARCH FOR LIGHT HYDRIDES IN THE ENVELOPES OF EVOLVED STARS

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Hydrides are important molecular constituents of the interstellar and circumstellar media, but there are still many questions regarding their variety and formation. In the envelopes of asymptotic giant branch and red supergiant stars, hydrides like silane SiH_4, phosphine PH_3, ammonia NH_3, and water H_2O are known to form, but have been observed in stark overabundance relative to predictions of chemical equilibrium models[a]. Diatomic hydrides (species with the form XH) are natural precursors to their more hydrogenated counterparts, and could therefore be crucial in constraining this puzzling chemistry. In this talk, I will present our search for the hydrides silicon monohydride (SiH), phosphinidene (PH), and iron hydride (FeH) using the Stratospheric Observatory for Infrared Astronomy (SOFIA). We used the German Receiver for Astronomy at Terahertz Frequencies (GREAT) instrument to search for rotational emission lines of these molecules along the line of sight toward the chemically rich circumstellar envelopes of the evolved stars IRC+10216 and VY Canis Majoris. In these spectra we detected high-energy ro-vibrational lines from over a dozen molecules, though no significant emission from our target molecules was found. We derive upper limits on their abundances in each source, discuss how these findings influence our understanding of hydride chemistry in circumstellar envelopes, and outline the observational steps needed to further constrain this chemistry.

[a] Agundez et al., A&A 637, A59 (2020)