

Rimmer et al. (2018) reported that temperate planets orbiting M-dwarf stars receive too little 200-280 nm flux to drive the photochemical homologation of HCN, a leading candidate for the prebiotic synthesis of ribonucleotides and thereby origin of life. They used this criterion to delineate an “abiogenesis zone”, and suggest that that planets orbiting M-dwarfs could not originate life (with a caveat regarding the most active, highly flaring stars like AD Leo). This finding has motivated a wide range of follow-up work (e.g., Spinelli et al. 2019, Gunther et al. 2020, Bogner et al. 2021). By contrast, our measurements show that HIP23309 emits adequate 200-280 nm radiation as a fraction of its bolometric luminosity to drive HCN homologation chemistry. Our work suggests that the SEDs of young M-dwarfs are conducive to HCN homologation chemistry, and that temperate planets orbiting the youngest M-dwarfs lie within the abiogenesis zone.



Hu et al. (2020) reported that planets with CO2-rich atmospheres orbiting M-dwarf stars were likely to have their atmospheric CO2 destabilize to CO and O2 (CO-O2 runaway). This is due to the different shape of the M-dwarf SED compared to the G-dwarf SED. The work of Hu et al. (2020) suggested that O2 on planets orbiting M-dwarfs was not necessarily a robust biosignature, because it could be efficiently and abiotically generated through photochemistry in some corners of parameter space. Applying our measured SED of HIP23309 to the same photochemical model of Hu et al. 2020, we find that a planet with CO2-dominated atmosphere orbiting HIP23309 is much less vulnerable to CO-O2 runaway compared to other M-dwarfs of similar spectral class such as GJ832 (M1.5). Indeed, it is even less vulnerable to CO-O2 runaway than HD85512, a K-dwarf. This demonstrates the need to characterize the specific UV SED of the host star for any planet for which one wishes to use atmospheric composition to make inferences regarding surface processes such as the presence or absence of life. Our work validates UVIT for such applications.