Abstract
Sulfur chemistry in exo-Earth: synergies between experiment and modelling.

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Thanks to state-of-the-art instruments, Earth-like planets are becoming possible targets to observe. Eleven Earth-sized planets have already been discovered in the Habitable Zone of their host star, including three in the TRAPPIST-1 planetary system. Characterizing the habitability of these planets requires an understanding of the evolution and stability of their atmospheres. In the search for life on exo-Earths, one of the main interests would be to better understand how the organic reservoir evolves in these atmospheres. Describing all the chemistry related to this reservoir corresponds to developing prebiotic chemistry on exo-Earths.

Sulfur may play a crucial role in prebiotic chemistry. The atmosphere of the early Earth, before 2.5 billion years, shows a sulfur isotopic fractionation linked to sulfur photochemistry. The sulfur cycle is a major component of the complex chemistry of the Venus atmosphere. And now JWST is detecting SO2 in the atmosphere of WASP-39 b. Overall, sulfur has been widely emphasized for some time, and continues to be present. However, the chemistry of sulfur is still poorly understood and leads to unexplainable observations, such as on Venus.

Our goal is to improve the understanding of sulfur chemistry in the exo-Earth through synergies between experimentation and modeling. Experimentation of sulfur under a wide range of oxidation and reduction conditions aims to discover the reactivity that can occur. Coupled with chemical models, we can better understand what is observed not only in atmospheres such as Venus, but also in observations of exoplanets, such as WASP-39 b and those to come. This will be done by analyzing reactor synthesized products and identifying new chemical pathways, tested with the chemical models.