Orianne Sohier[1], A. Y. Jaziri[1], L. Vettier[1], N. Carrasco[1], A. Chatain[1], L. Maratrat[1]

[1] LATMOS, UVSQ Université Paris-Saclay, CNRS, Guyancourt, France

Understanding the chemistry of temperate exoplanets atmospheres:

A study of oxidized organic compounds as precursors of photochemical condensates

Characterizing the atmospheres of small temperate exoplanets poses a major scientif challenge. The James Webb Space Telescope gives us the opportunity to study temperate exoplanets as small as mini-Neptunes. Recent observations of K2-18b and TOI-270d have revealed atmospheres rich in hydrogen and carbon compounds. Methane and carbon dioxide have been detected in significant amounts. However, understanding the chemistry governing these atmospheres remains largely unconstrained. Therefore, modeling and laboratory experiments are necessary to better understand these observations. Developing our knowledge of these atmospheres will help to characterize their habitability.

In this context, we have conducted experimental simulations. Using a cold plasma reactor, we simulate the out-of-equilibrium chemistry occurring in the upper layers of temperate exoplanets. We used mass spectrometry and infrared spectroscopy to track the chemical evolution of gas mixtures similar to exoplanetary atmospheres. Our observations highlight the production of complex organic compounds, carbon monoxide, and water vapor. Additionally, our first results suggest that oxidized organic compounds are formed, which are potential precursors to photochemical condensates of prebiotic interest.