Insights on the formation of Uranus and Neptune through thermochemical modelling

T. Briand[1], V. Hue[1], O. Mousis[1,2] and T. Cavalie[3,4]

1. Aix-Marseille Université, CNRS, CNES, Institut Origines, LAM, Marseille, France
2. Institut Universitaire de France (IUF), Paris, France
3. Laboratoire d'Astrophysique de Bordeaux, Univ. Bordeaux, CNRS, B18N, allée Geoffroy Saint-Hilaire, 33615 Pessac.
4. LIRA - Laboratoire d'Instrumentation et de Recherche en Astrophysique, Observatoire de Paris, Section de Meudon, 5, place Jules Janssen - 92195 MEUDON Cedex

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Uranus and Neptune are the most distant and the least explored planets within our solar system. To this day, the formation history of these ice giants remains uncertain. Better understanding of their deep atmospheric composition helps constrain where and how both planets formed. Remote sensing techniques can only probe the atmosphere down to the ~1 bar level. Similarly, an entry probe as part of the Uranus Flagship mission may only measure the atmospheric composition down to a few bars. Several disequilibrium species in the deeper troposphere are quenched to the pressure levels these measurements are made. Atmospheric models are thus needed to interpret how the measured abundances reflect the deeper atmospheric composition

Using the thermochemical & diffusion model of Cavalie et al. (2017), we aim to take advantage of such disequilibrium species to further constrain Uranus and Neptune deep atmospheric composition. We have updated the model to consider the meridional variability of several parameters in the troposphere. We investigate how the main physical and chemical parameters affect the retrieved deep elemental abundances. We present preliminary ranges of deep oxygen abundances in both planets. We discuss how such values can be used in a protoplanetary disk formation model (Mousis et al. 2024), and what it may teach us about the formation of these planets.