

A new chemical scheme to study exoplanets atmospheres

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Abstract

At the time when the existence of nearly 2000 exoplanets have been confirmed, it is known that a wide variety of elemental chemical composition exists, that is to say different metallicities and C/N/O/H ratios [1, 2, 3, 4]. Atmospheres with a high C/O ratio (above 1) are expected to contain an important quantity of hydrocarbons, including heavy molecules (with more than 2 carbon atoms). To study correctly these kind of atmospheres, a chemical scheme adapted to this composition is necessary.

In this context, we have implemented a new chemical scheme than can describe the kinetics of species with up to 6 carbon atoms (C₆ scheme). This chemical scheme is totally new in planetology because it has been developed with specialists of combustion and validated through experiments on a wide range of temperature (300 - 2500 K) and pressure (0.01-100 bar). This large range of validation allow us to study a broad variety of atmospheres.

To determine in which studies this enhanced chemical scheme is mandatory, or in which one a smaller one can be sufficient, we have created a grid of 12 models to explore different thermal profiles and C/O ratios (solar and >1). For each of them, we have compared the chemical composition determined with a C₂ chemical scheme (species with up to 2 carbon atoms) [5] and with the C₆ scheme. We will present these results.

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References

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