Dynamical photochemical solver coupled to chemical disequilibrium applied to Archean atmospheres

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The study of planetary atmospheres where observational parameters are indirect, scattered or unachievable needs to rely on physical and chemical first principles. The calculation of chemical networks for these type atmospheres requires the resolutions of large numbers of chemical reactions. The aim of this work is to construct a planetary atmosphere chemical network solver that relies on a minimal number of observational parameters.

We present the latest development in our effort to develop such model. The main chemical solver implemented in our model is the KROME package [1]. This solver is adaptable to any environment and has the ability to solve customizable chemical networks with an arbitrary number of reactions and chemical species. In this report we present a photochemical one-dimensional model that solves the radiative transfer using ultraviolet opacities fully-consistent with the photo-chemical evolution. Additionally the model has been equipped with a set of equations to calculate disequilibrium effects on the chemical network. We present our results obtained at this stage and compare them to data in the literature, zero-dimension single chemistry models and chamber experiments is also presented.

[1] Grassi *et al*. (2014) *Mon. Not. R. Astron. Soc.*. **439 (3)**, 2181-2187.