Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16562

Exploring Non-isobaric Treatment in Exoplanetary Atmospheric Retrieval

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To characterize an exo-atmosphere directly from their spectra, one can apply an inverse technique known as atmospheric retrieval, i.e., the use of an observed transmission spectrum to infer the atmospheric properties of a planet, such as temperature, chemical composition, circulation, and presence of clouds. This work intends to upgrade the retrieval code initially developed by [1], by retrieving new parameters and including new opacity sources, i.e., different molecules and physical effects. Furthermore, we adapt the code to consider an isothermal, non-isobaric transit chord, setting atmospheric opacity sources to a full pressure dependency. We perform isobaric and non-isobaric retrievals in 38 HST WFC3 near-infrared transmission spectra to establish if these modifications significantly affect the results, and if a non-isobaric treatment is required to properly estimate atmospheric parameters. We find that most results agree with isobaric analyses by FH18, mainly retrieving cloud-free and constant/grey cloud atmospheres. We take a closer look at inconsistencies, and discuss possible explanations for the disparity between models. Finally, we point to new approaches that could probably help identify additional atmospheric features imprinted in the spectra, considering complementary data in a wider wavelength range, as well as retrieval analyses using upcoming higher-quality JWST spectra.

[1] Fisher, C. & Heng, K (2018), *MNRAS* 481, 4698