The Journal of Open Source Software

taurex-emcee: A TauREx 3.1 plugin for retrievals using the emcee sampler

Andrea Bocchieri [1], **Quentin Changeat** [2], **Lorenzo V. Mugnai** [3,4,5], **and Enzo Pascale** [1]

1 Department of Physics, La Sapienza Università di Roma, Piazzale Aldo Moro 2, Roma, 00185, Italy **2** European Space Agency (ESA), ESA Office, Space Telescope Science Institute (STScI), Baltimore, MD, 21218, USA **3** School of Physics and Astronomy, Cardiff University, Queens Buildings, The Parade, Cardiff, CF24 3AA, UK **4** Department of Physics and Astronomy, University College London, Gower Street, London, WC1E 6BT, UK **5** INAF, Osservatorio Astronomico di Palermo, Piazza del Parlamento 1, Palermo, I-90134, Italy

DOI: N/A

Software

- Review
- Repository
- Archive

Editor: Open Journals

Reviewers:

- @openjournals

Submitted: 01 January 1970
Published: 01 January 1970

Summary

The `taurex-emcee` plugin is a plugin for the TauREx 3.1 retrieval code that allows users to perform retrievals using the emcee sampler.

Optimized sampling methods are a key component of any retrieval code. Nested samplers are generally considered the most robust sampling method for retrieval of exoplanet atmospheric spectra, and are natively implemented in TauREx 3.1. The estimation of the Bayesian `evidence` is the primary product of nested samplers, whereas the estimation of the Bayesian `posterior` is a by-product. Compared to nested samplers, affine-invariant ensemble samplers sample directly from the Bayesian `posterior`, and therefore the interpretation of the results is more straightforward, even for non-expert users. Moreover, in some instances nested samplers may require to define bespoke priors to ensure that the parameter space is thoroughly explored, whereas affine-invariant ensemble samplers asymptotically sample the entire parameter space. The trade-off being that the latter are more computationally expensive, and the computational time scales much faster with dimensionality.

Statement of need

The emcee sampler is a popular affine-invariant ensemble sampler that is widely used in the astronomy community. However, the emcee sampler is not implemented in the TauREx 3.1 retrieval code, which is a popular open-source code for exoplanet atmospheric retrievals. The `taurex-emcee` plugin implements the emcee sampler in TauREx 3.1, allowing users to perform retrievals using the emcee sampler. The `taurex-emcee` plugin is compatible with the TauREx 3.1 parallelization framework, allowing users to perform parallelized retrievals using the emcee sampler.

Acknowledgements

Andrea Bocchieri and Enzo Pascale acknowledge funding by the Italian Space Agency (ASI) with `Ariel` grant n. 2021.5.HH.0.

References