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PyFHD: Python Fast Holographic Deconvolution, a translation of FHD from IDL to Python

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Summary

Python Fast Holographic Deconvolution (PyFHD), is an open source, a python translation of the open source package Fast Holographic Deconvolution (FHD). FHD and therefore, PyFHD has been built for fast mode Epoch of Reionisation (EoR) analysis, serving as a testbed for new ideas, supporting new instruments, supporting both evolutionary and revolutionary cutting edge Epoch of Reionisation, while also giving researchers a package to train the next generation of Epoch of Reionisation astronomers. PyFHD has been primarily tested with analysing Murchison Widefield Array (MWA) observations, reading UVFITS and METAFITS files, importing both FHD (Barry et al., 2019; Sullivan et al., 2012) or WODEN (Line, 2022) skymodels and importing beams produced by FHD to perform calibration, gridding and HEALPIX file generation required for the error propogated power spectrum with interleaved observed noise (ϵppsilon) package (Barry et al., 2019). PyFHD also supports beamforming in a similar format to FHD, utilising puvdata (Hazelton et al., 2017; Keating et al., 2025) where possible and translation of FHD where pyuvdata couldn't achieve the same result, though this part of the package is in alpha, and has problems that need to be solved through additional research and/or translation of the FHD package.

Statement of need

The most successful open-source Epoch of Reionisation (EoR) pipeline, Fast Holographic Deconvolution (FHD) (Barry et al., 2019; Sullivan et al., 2012) was built using the Interactive Data Language (IDL), a proprietary language which has significant limitations in regards to it's cost, terms of use, and licensing thereby preventing those in the EoR community from using and/or contributing to FHD, while also preventing the EoR community from growing. The use of IDL for FHD has also made it difficult to utilise FHD results in other packages and in other languages as the resulting save files that IDL produces can be difficult to read, while also being very slow to read into languages like Python when utilising using SciPy's `readsav` function (Virtanen et al., 2020). To remove the limitations of IDL, attaining better integration with other packages, and to best support the training of a new generation of EoR astronomers, FHD has been translated to Python,

Testing of the Translation

Citations

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