The **MIRI MRS** can be used to measure the **C/O ratio** of sub-stellar atmospheres.

An atmospheric retrieval study using simulated MIRI MRS observations.

Evert Nasedkin, Polychronis Patapis, Sascha Quanz
ETH Zürich Exoplanets and Habitability

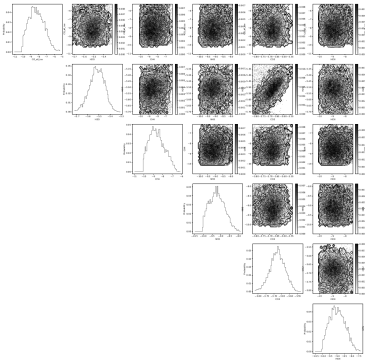
MIRI

- The MIRI MRS is an IFS onboard JWST which covers the 4.8-28 micron range.
- With R≈3000, we can measure the emission spectra of colder exoplanets and brown dwarfs.

Methods

- Mock MRS observations were generated using high resolution spectra computed petitRADTRANS, which were run through the MIRISIM instrumental simulator.
- These detector images were then processed into 1D spectra using the JWST pipeline.
- An atmospheric retrieval was performed using petitRADTRANS and pyMultinest to obtain posterior distributions for various parameters.

Results

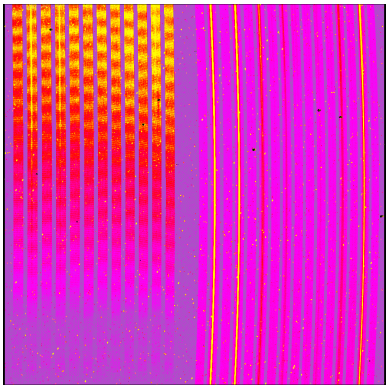


- We successfully retrieved molecular abundances for an exoplanet-like atmosphere. We derived a **C/O ratio of 0.48±0.12**, within 25% of the nominal value of 0.64.
- The use of mid-infrared wavelengths allows us to identify species that exist at lower temperatures (i.e. NH_3)
- The use of nested sampling reduces the computational time of the retrieval when compared to an MCMC approach.

Instrumental Effects

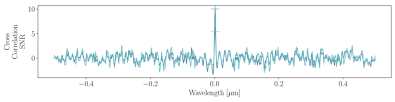
We examined how instrumental effects - in particular thin-film **fringing** in the detector layers - will impact retrieved atmospheric parameters.

This is a 10% effect which depends on the source position and geometry, the wavelength and the location on the PSF. It is not yet fully corrected for.



Example of a fringing model used in MIRISIM.

We used a cross correlation with the known input spectrum to quantify the effect of fringing on the extracted spectra, and found a reduction of 50% in SNR when compared to a case with no fringing. Work is ongoing to determine the impact of fringing on the posterior distributions of atmospheric parameters.



Comparison of uncorrected fringing (light blue) to 'perfectly corrected' fringing (dark blue) for a single MIRI channel.

Special thanks to Paul Molliere for petitRadTrans and Ioannis Argyriou for his work on fringing in the MIRI MRS.

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