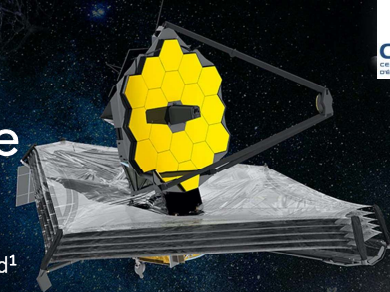




Direct detection of exoplanets with MIRI on the James Webb Space Telescope

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Challenge: Direct imaging requires very high contrast at small angular separations.

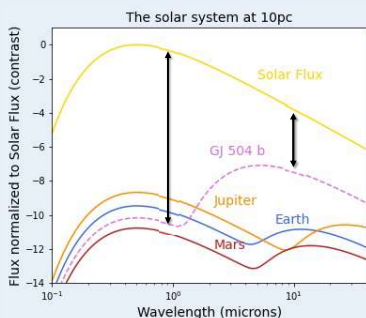


Mid IR advantages:

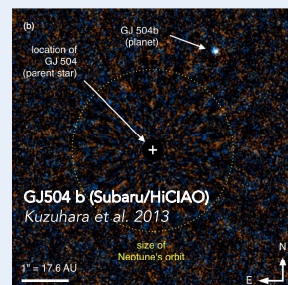
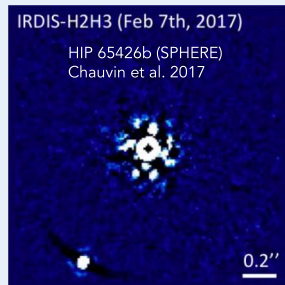
- Reduced contrast between the star and the planet
- Peak of emission of young giant planets
- Relevant for the detection of molecular signatures present in their atmospheres

Favorable cases

- Young giant planets
- Distant from their host star
- IR Observations



Solution: Coronagraphic images (star hidden behind a mask) of young, long-period giant planets with an 8-meter telescope.



- Only in near IR
- Still impacted by the deformation due to the Earth atmosphere

Observations required from space in mid IR

JWST: 4 instruments including **MIRI** (Mid-IR Instrument)

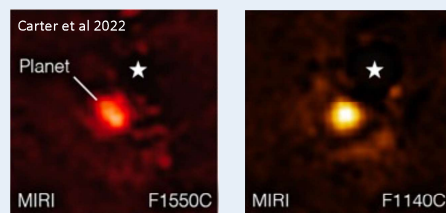
- Spectral range from 5 to 28 μm
- First data available for direct imaging above 5 microns !

Instruments: Imager, Coronagraph, Low Resolution Spectrometer and Medium Resolution Spectrometer

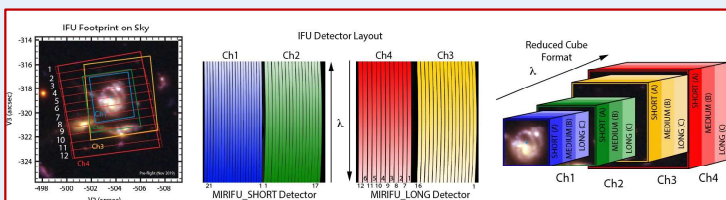


1 - MIRI coronagraphs:

First imaged exoplanet (HIP 65426 b)



2 - MIRI Medium Resolution Spectrometer (MRS)

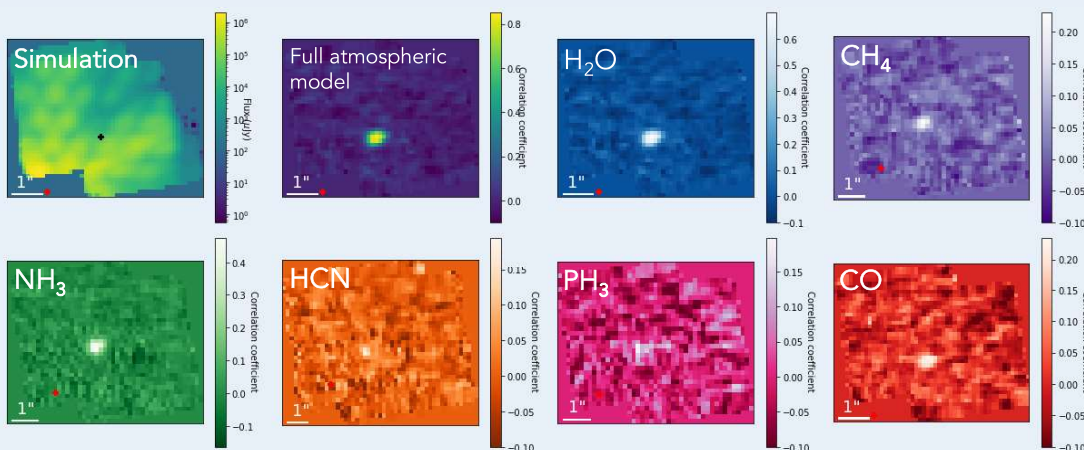


Integral field spectrometer : spectral and spatial information

→ Allows us to distinguish spectrally and spatially the star and the planet because their spectra are different.

"Molecular mapping" with MRS simulated data of the system GJ 504

- Correlation with planetary atmospheric model spectrum and molecular template spectra
- Increases the detection
- Evidence for the presence of molecules



Diversity in the population of exoplanets : constraining the various planetary formation and evolution scenarios

- MIRI allows for the **first detection** of exoplanets in mid-IR.
- MRS will provide **complementary data** to characterize the atmosphere of young, giant planets.
- Detection of molecules that have previously never been confirmed in exoplanets (for example PH₃) should be possible for cold planets at large separations (such as GJ 504 b).