SPICA Science Overview

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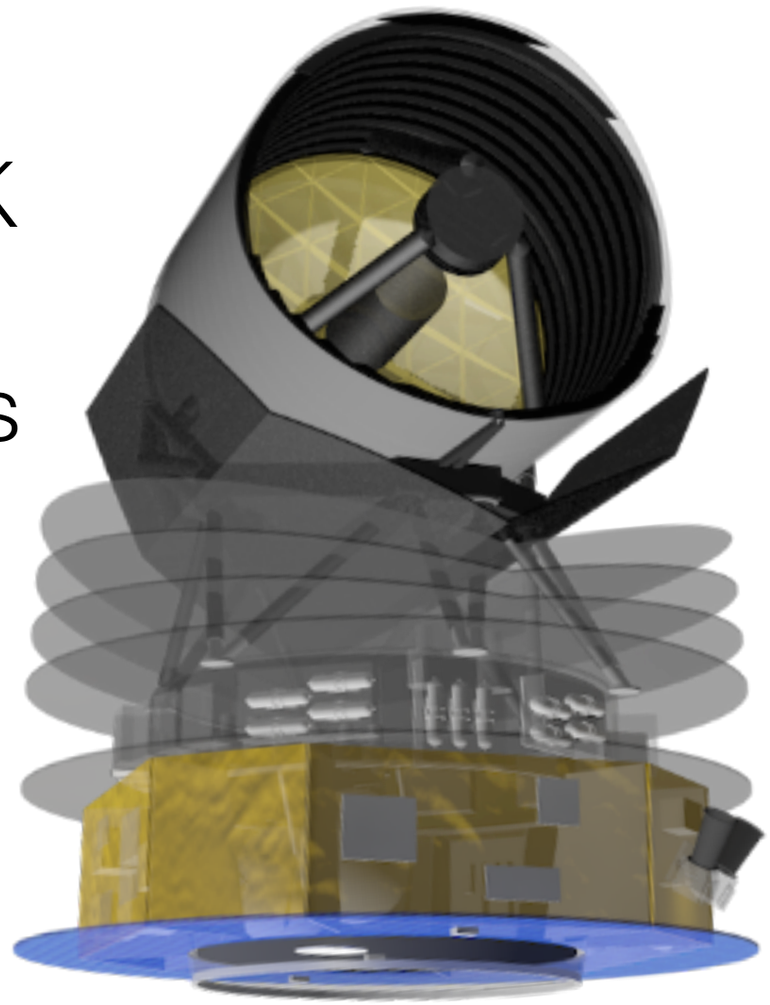
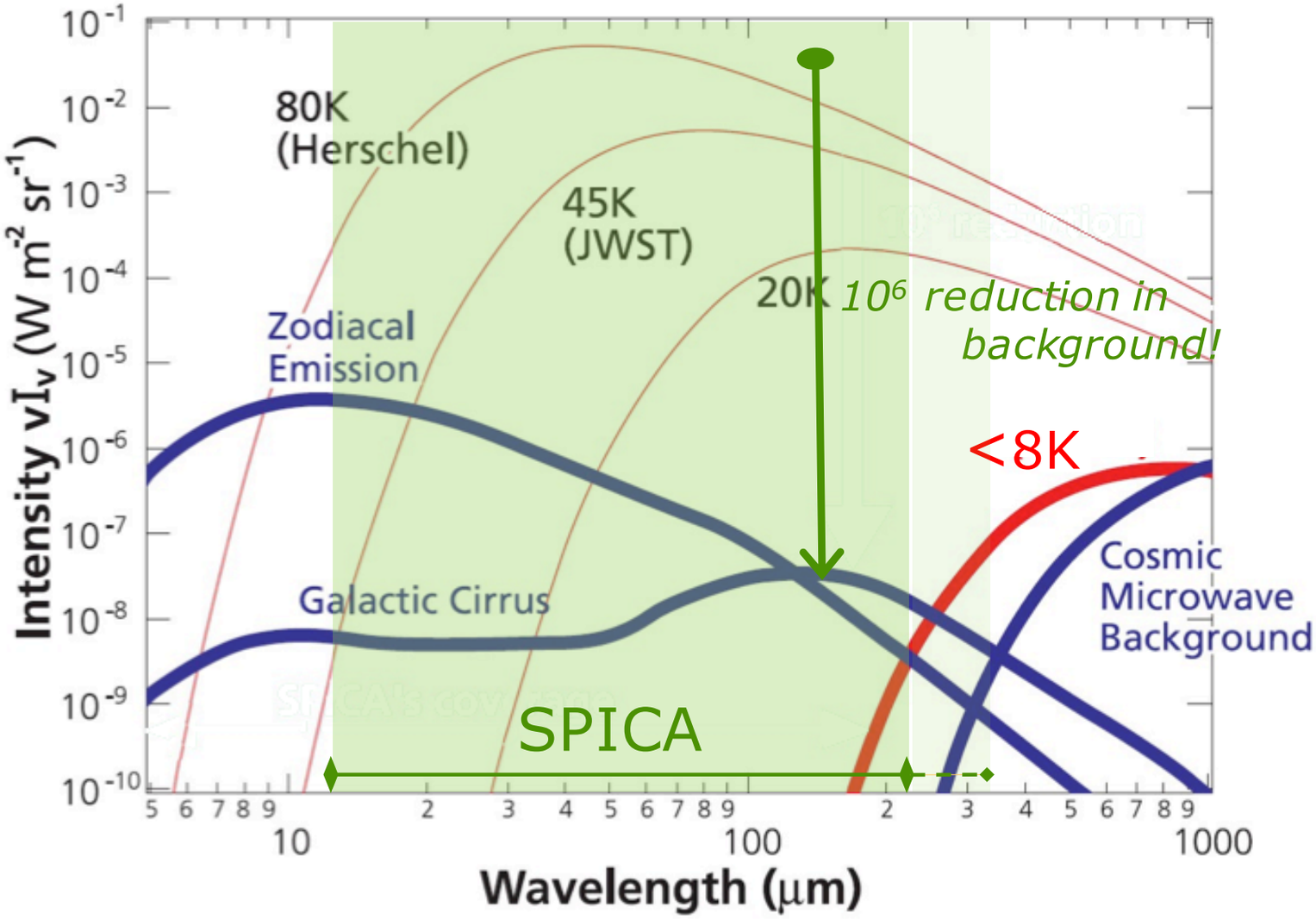
SPICA Key Facts

- Large (2.5m) primary cooled to ~8K
- Sensitive spectroscopic instruments
  - SAFARI for the far-IR
  - SMI for the mid-IR

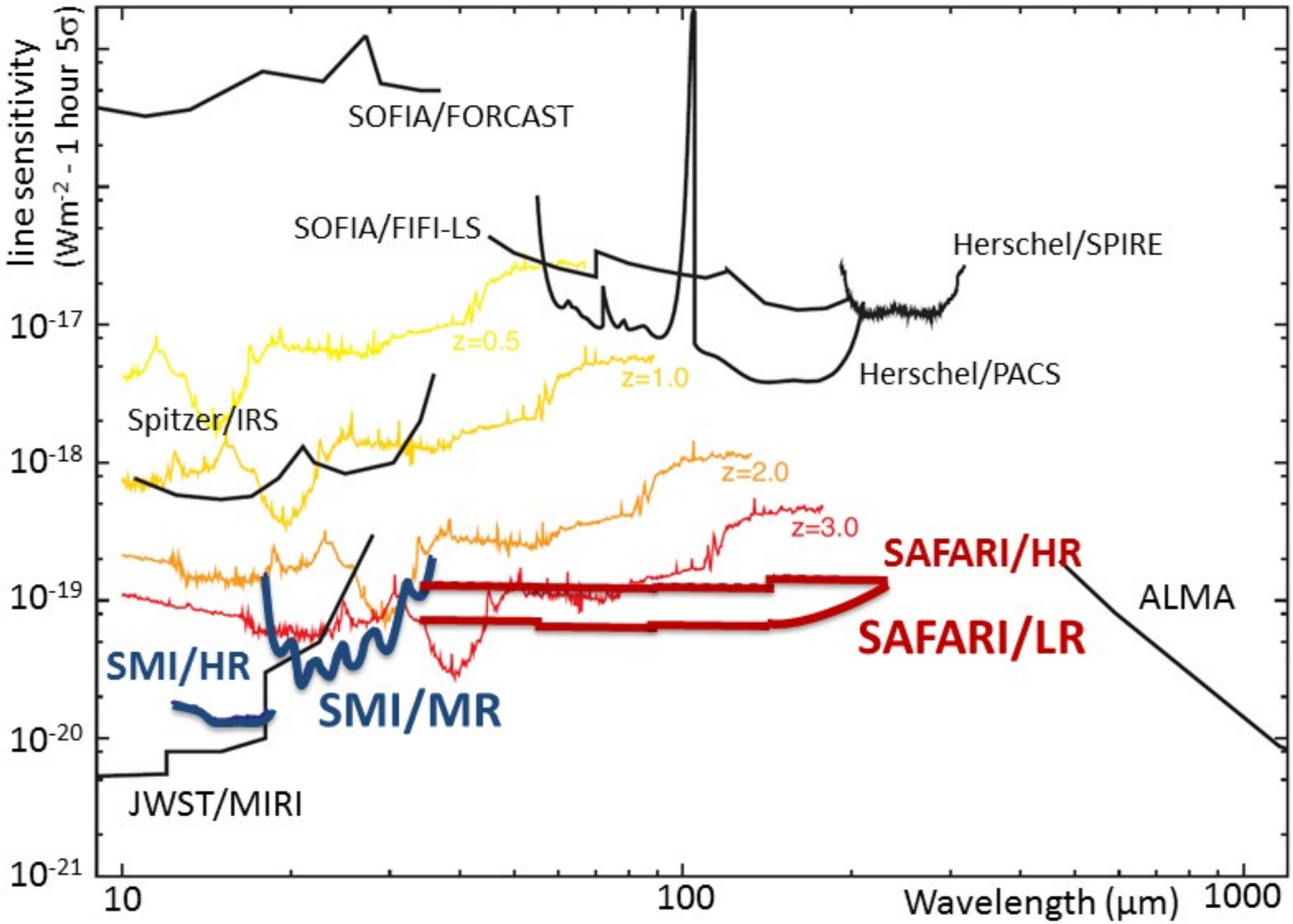


Cold Primary



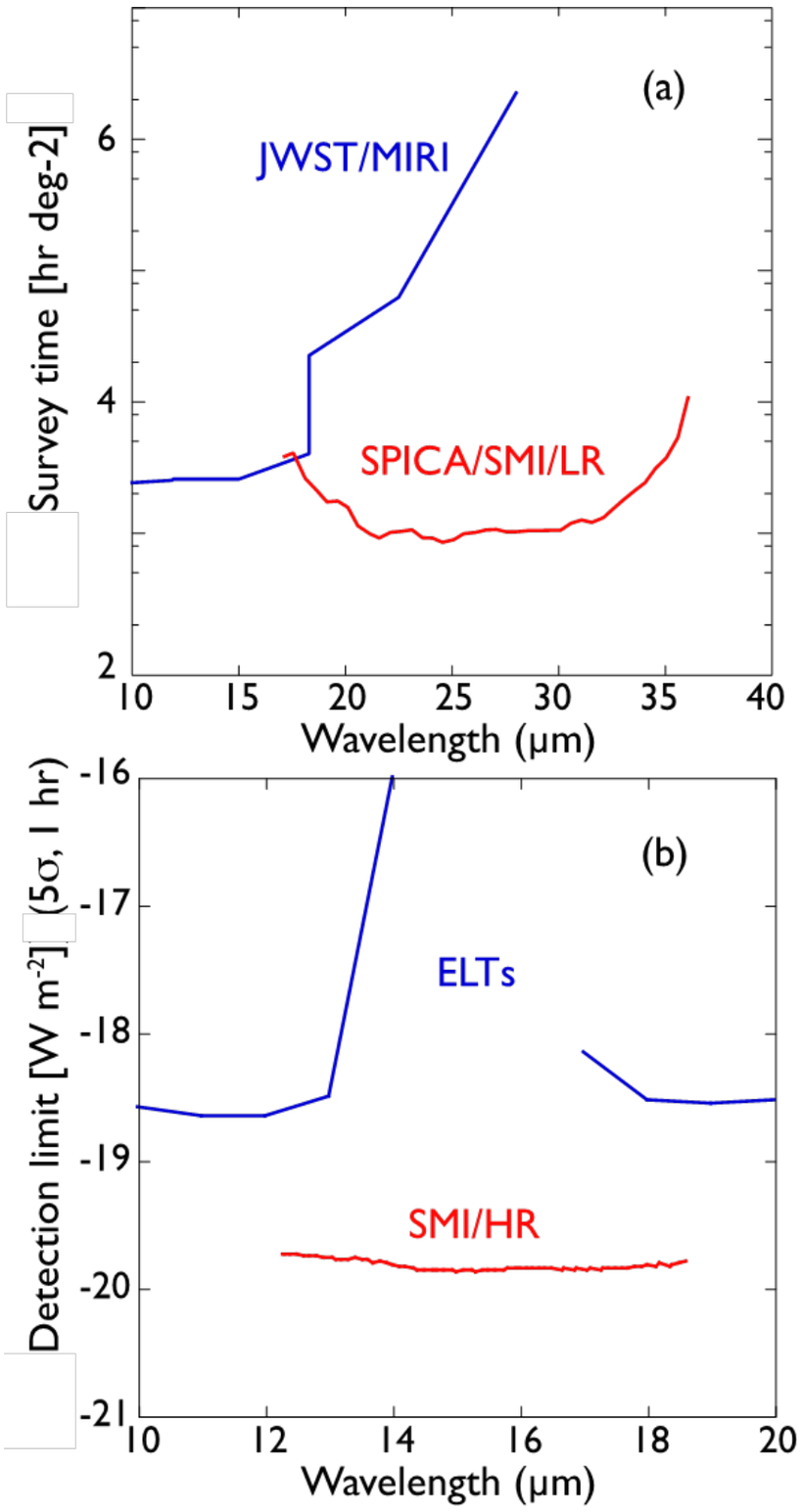
- 1 million factor background reduction compared to Herschel

Sensitivity



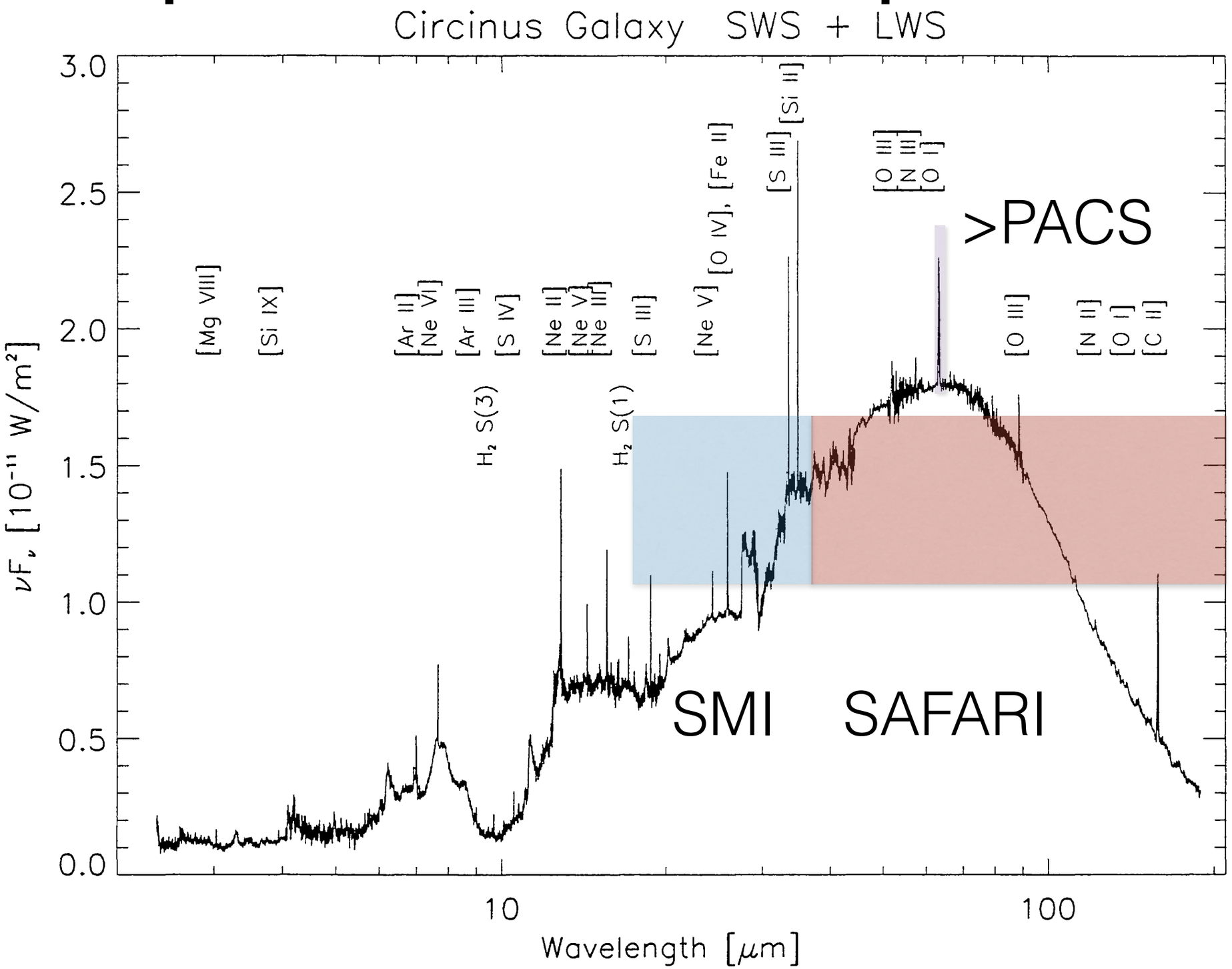
- 100x more sensitive than Herschel for spectroscopy

Sensitivity



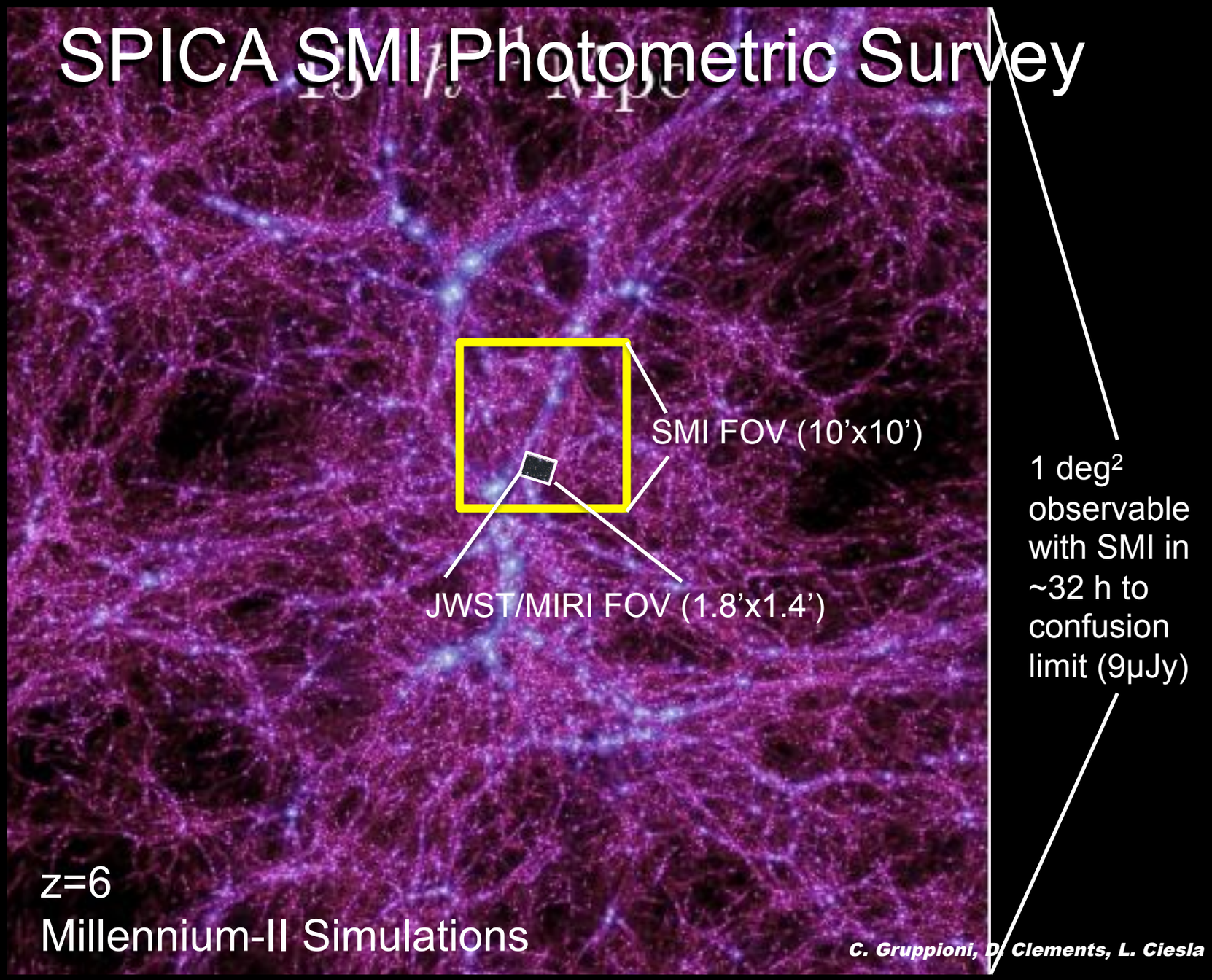
- More sensitive than JWST at >20 microns
- More sensitive in high-res mode than ELTs in the mid-IR
  - And no restrictions on wavelengths

Speed: Full Spectra



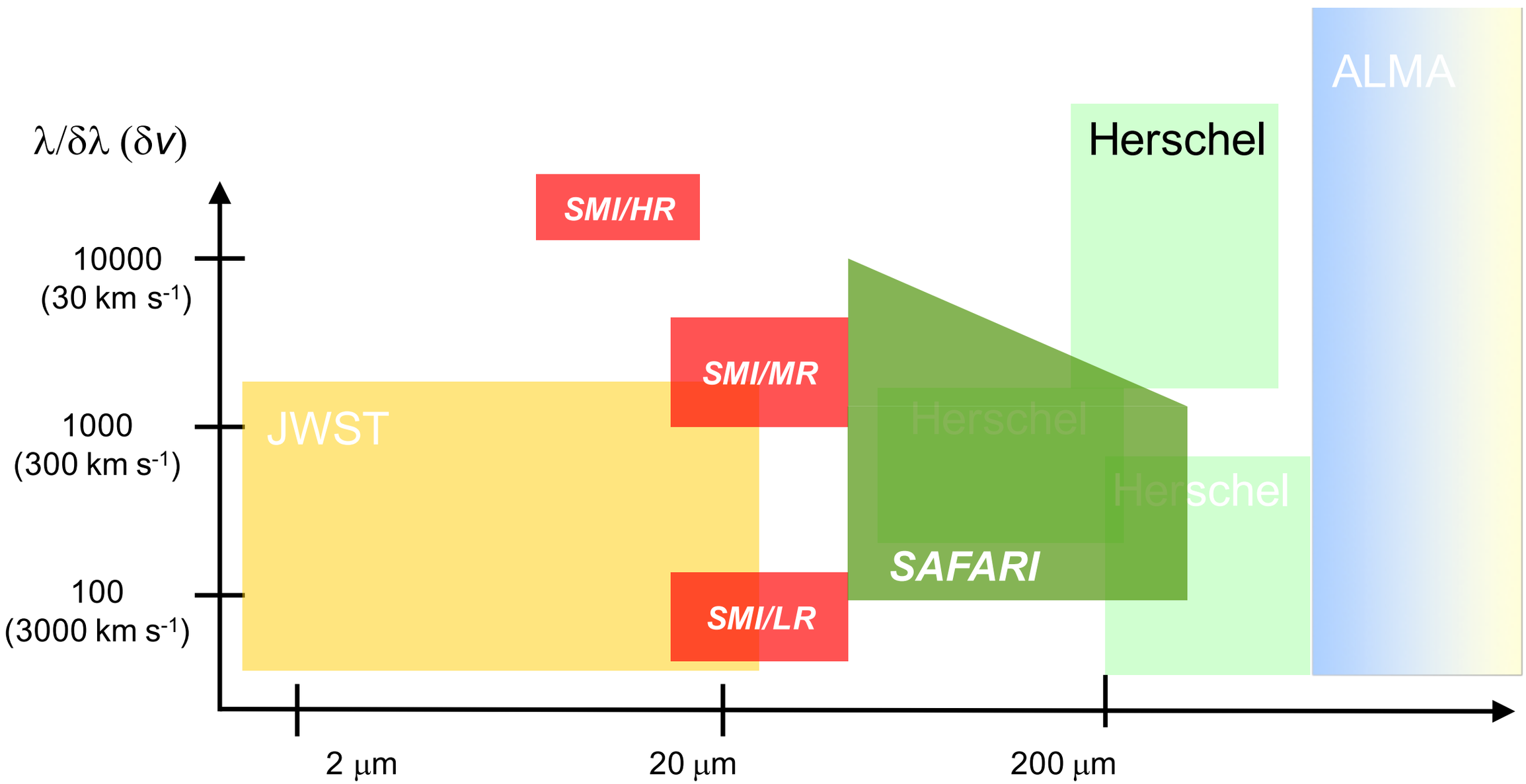
- Get full spectrum not just a line: every observation a spectral survey

Speed: Imaging

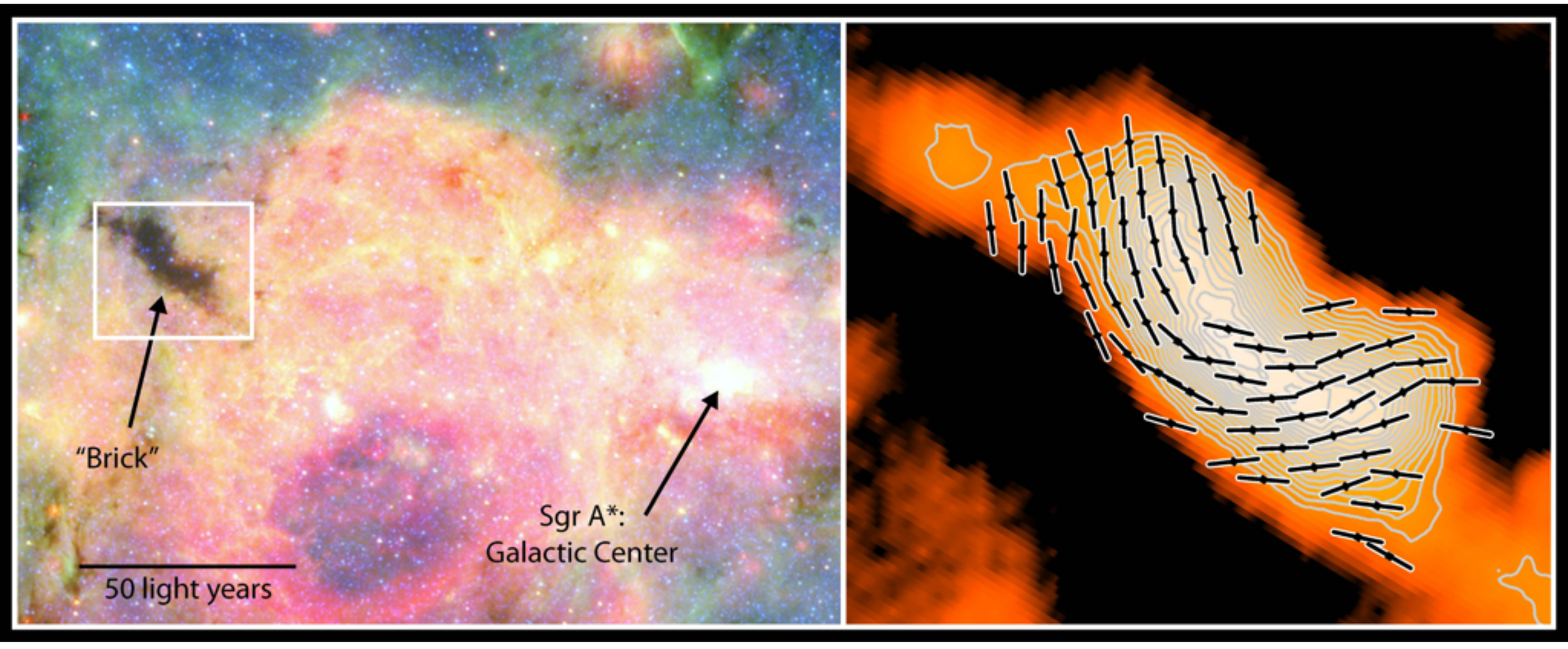


- SMI reaches ~same depth as JWST in same time, but over ~10'x10': Surveys ~ 100x faster

Resolution & Wavelength Coverage



Polarisation



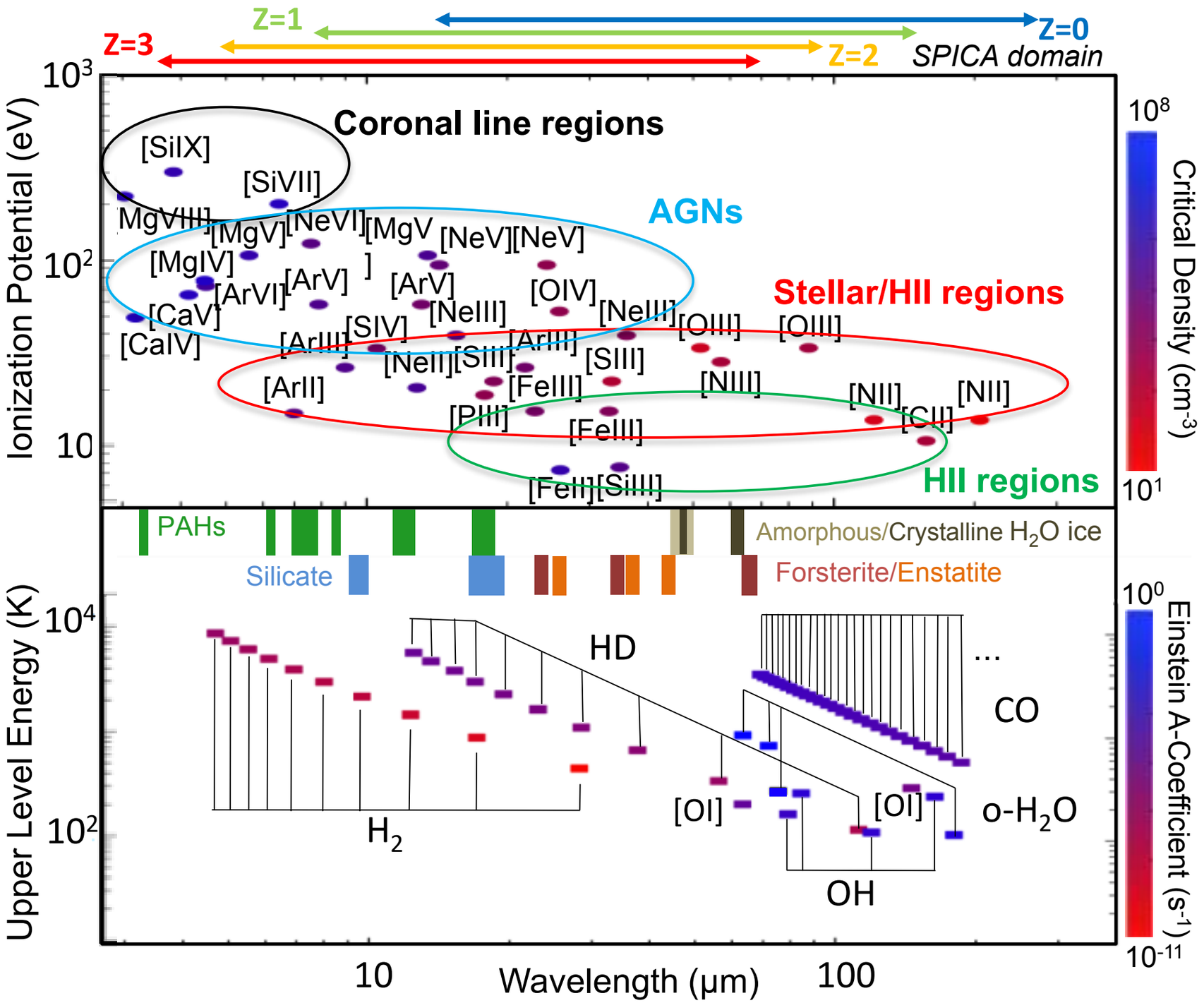
Pillai+ 2016

- Far-IR polarimetry: a new window on magnetic fields

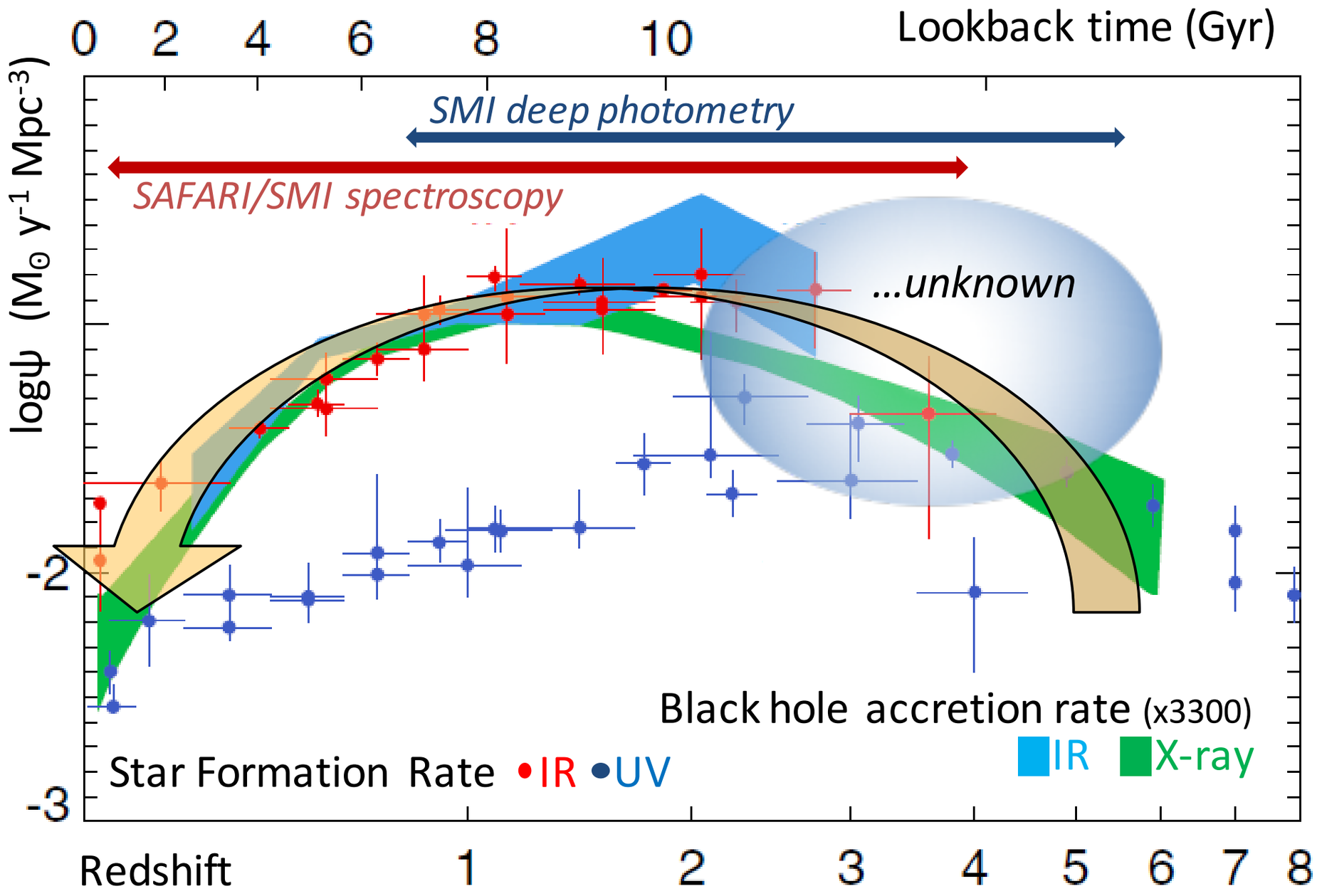
What to use it for?

- Wide range of possibilities to be covered in talks later today
    - Keynote talks on broad areas
    - Smaller talks on specific issues
    - Not comprehensive!
    - Please think what you want to do with SPICA
- Overview of science case for SPICA here

Why Mid/Far-IR Spectroscopy?

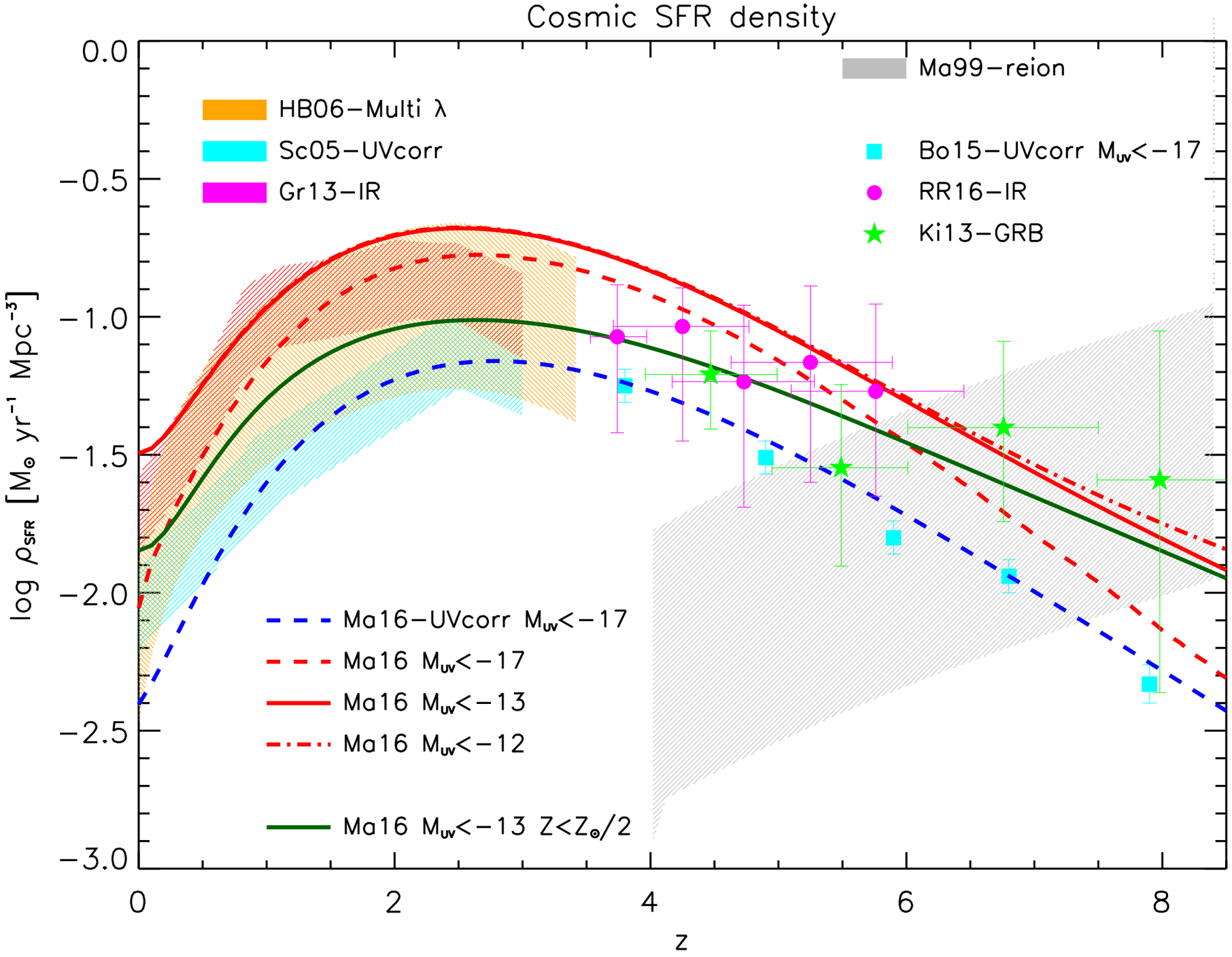


- Obscuration independent diagnostic lines for star formation, AGN, water and for solid state features



- Determine SF & BH contribution to energy generation out to z>3

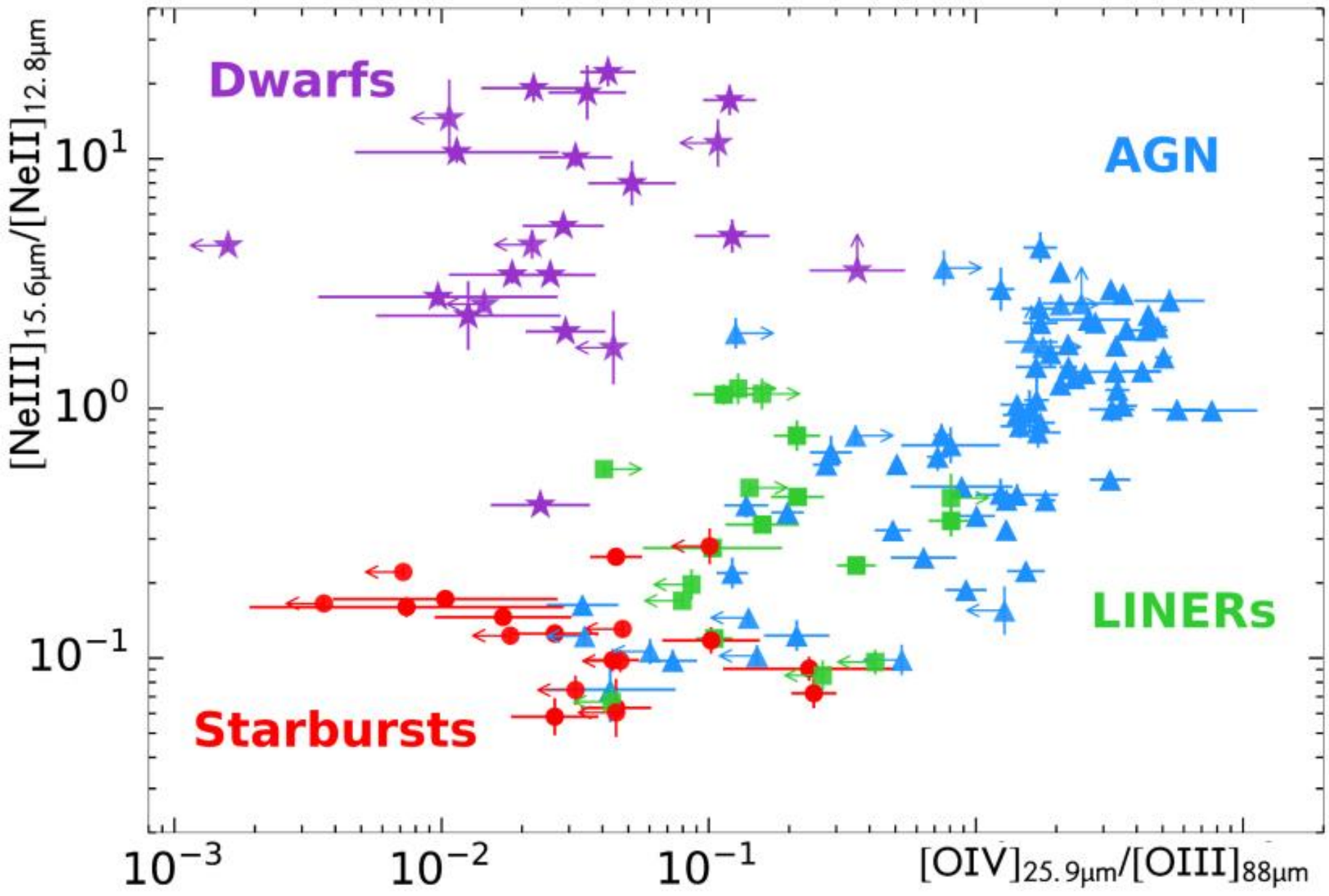
- Physics not just counts: determine why SFR & BHA peaks at z~2-3 (and if it does!)



Lapi+ 2016

- Obscured SFR may not drop as rapidly as suggested by uv/optical

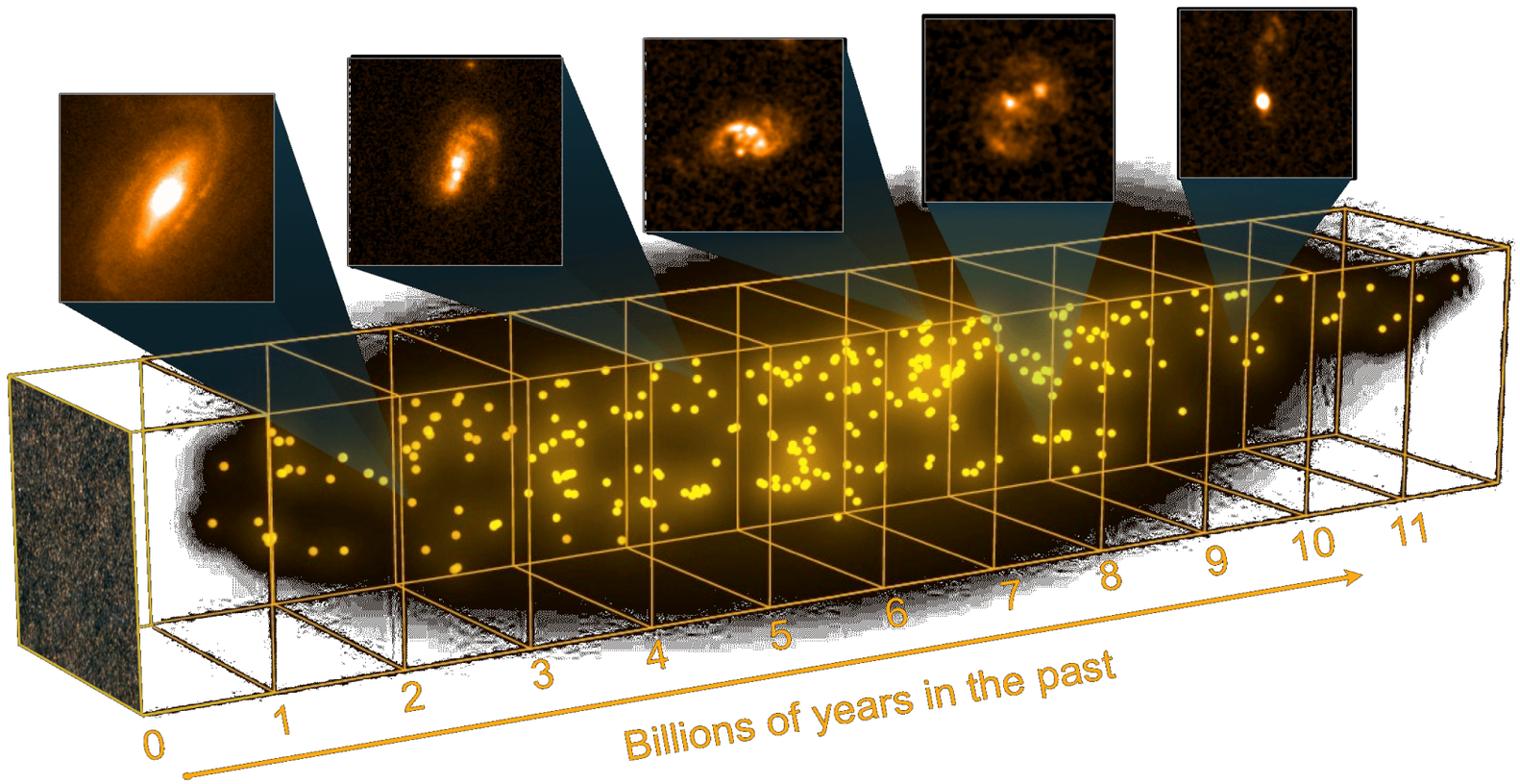
Local Demonstration



Fernandez-Ontiveros+ 2016

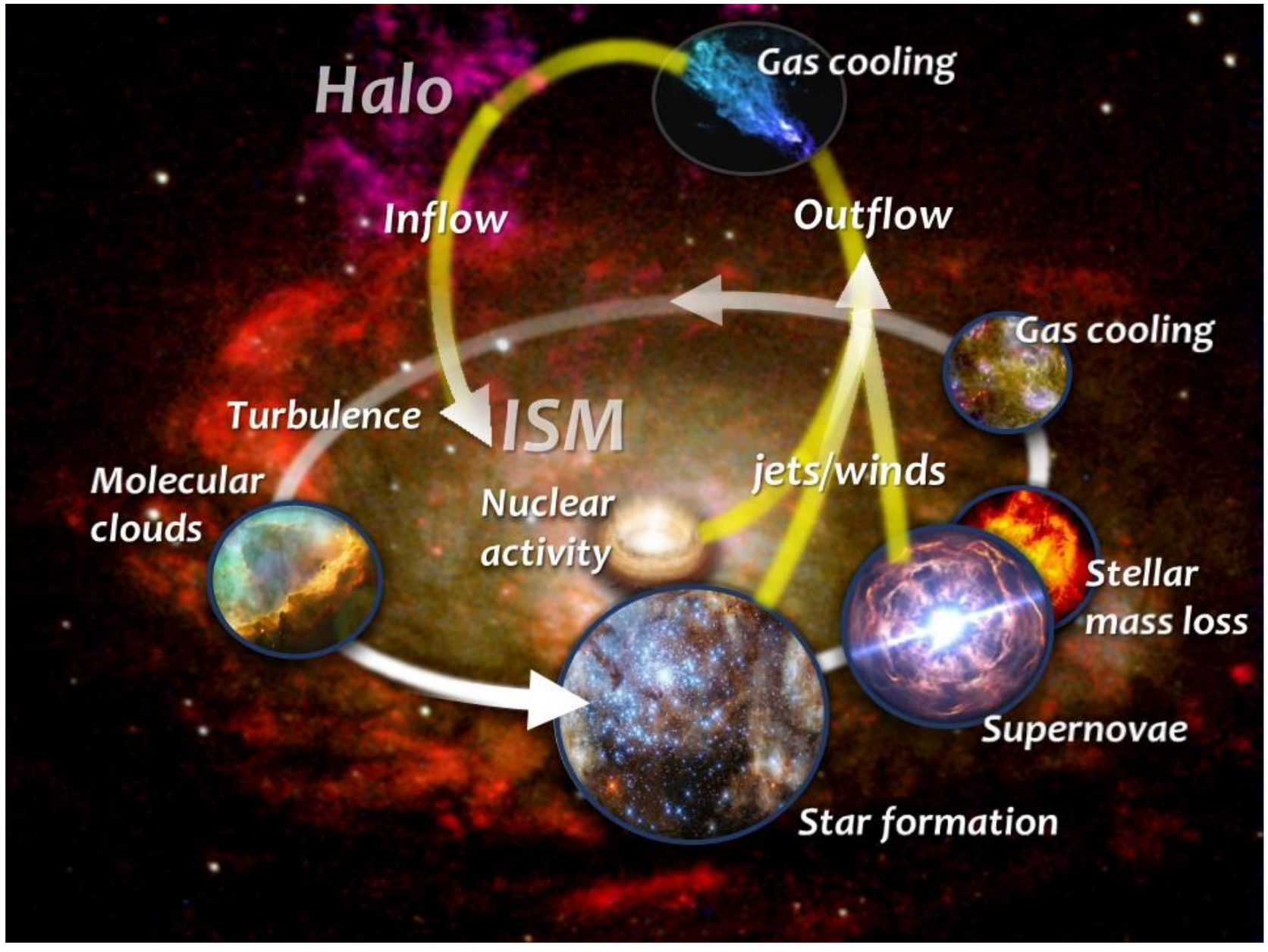
- SPICA can do this out z~3 or more

Diagnostic tools out to z~3



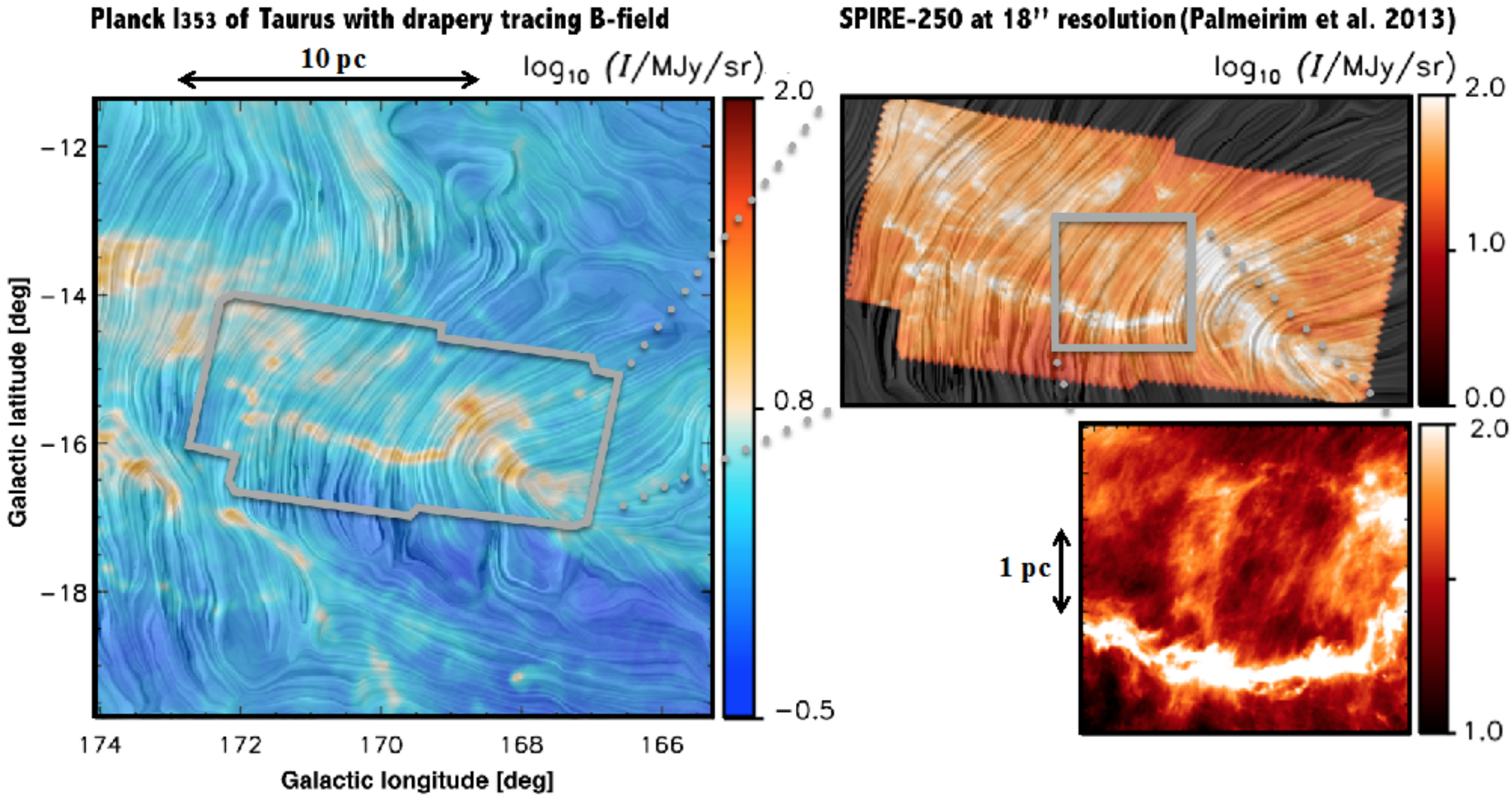
- Line-ratios: physical state of dust and ionised gas
- Line profiles: outflow/infall, cycling of matter
- Line strengths: metal enrichment
- Discriminate between Active Galactic Nucleus and star-formation

The Baryon Lifecycle



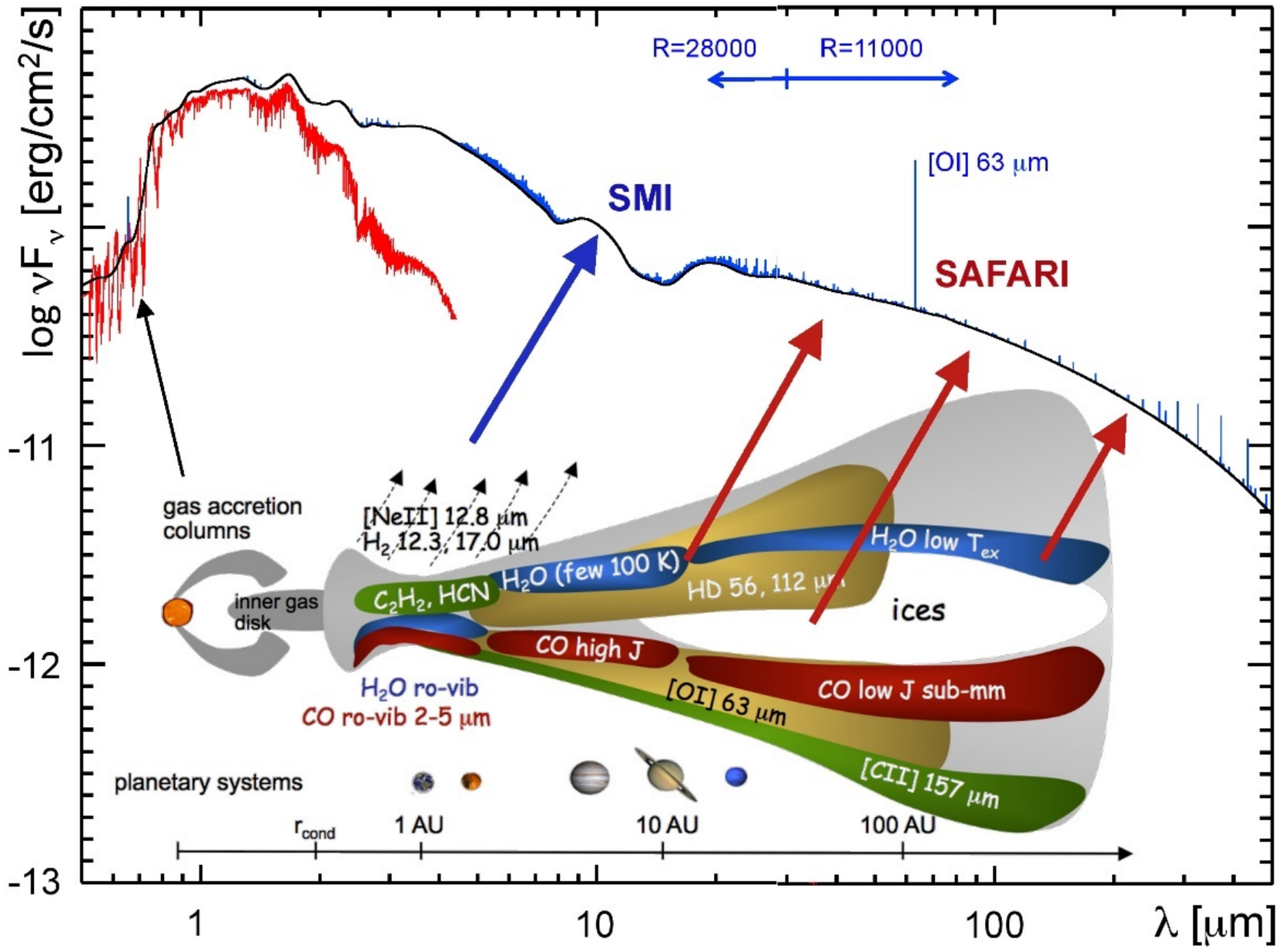
- All aspects of the galactic baryon lifecycle can be observed
- Locally in detail, and across large samples at higher redshift

Star Formation



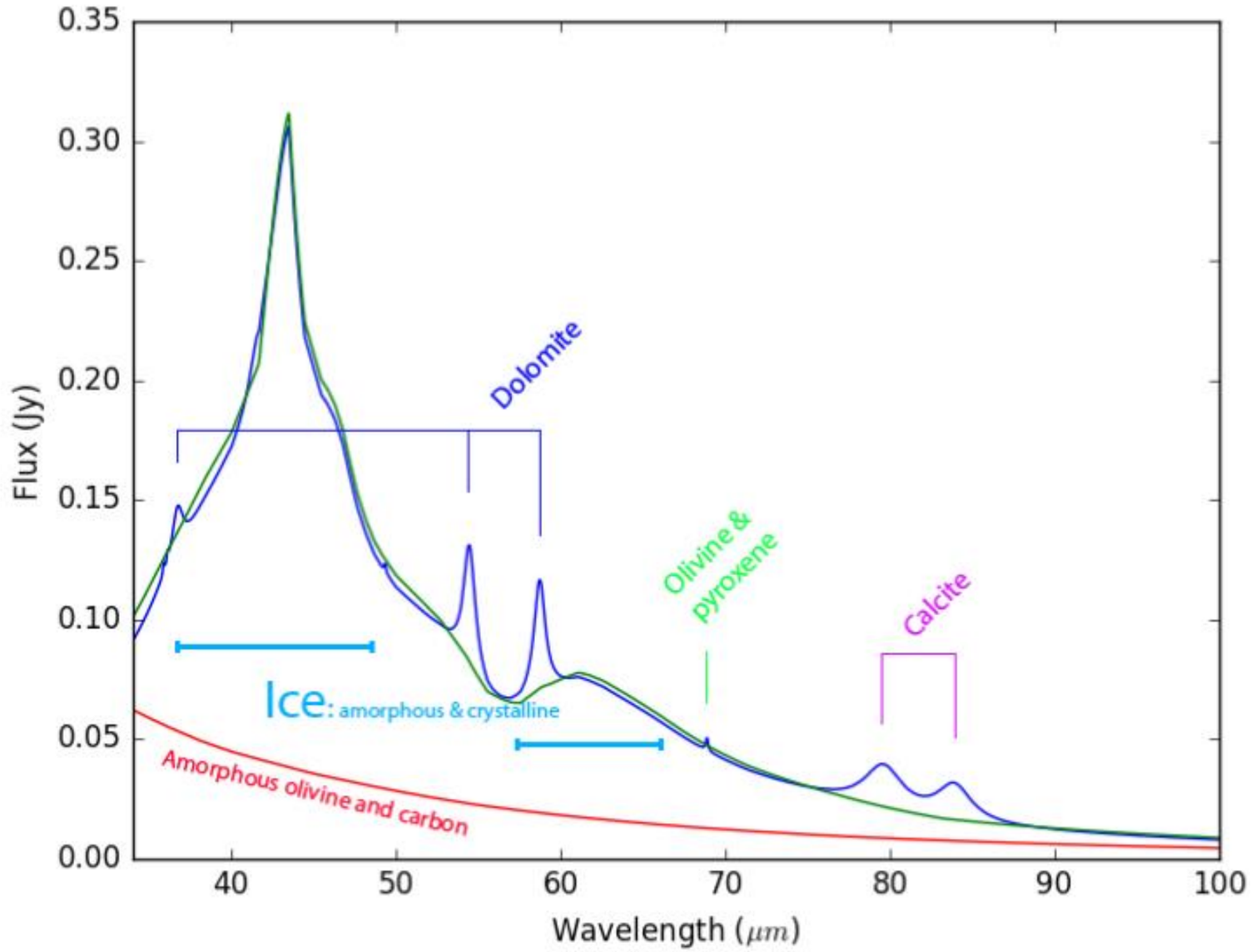
- Magnetic fields perpendicular to filaments in SF regions
- What is happening inside the filaments on 5-15” scales?

Protoplanetary disks

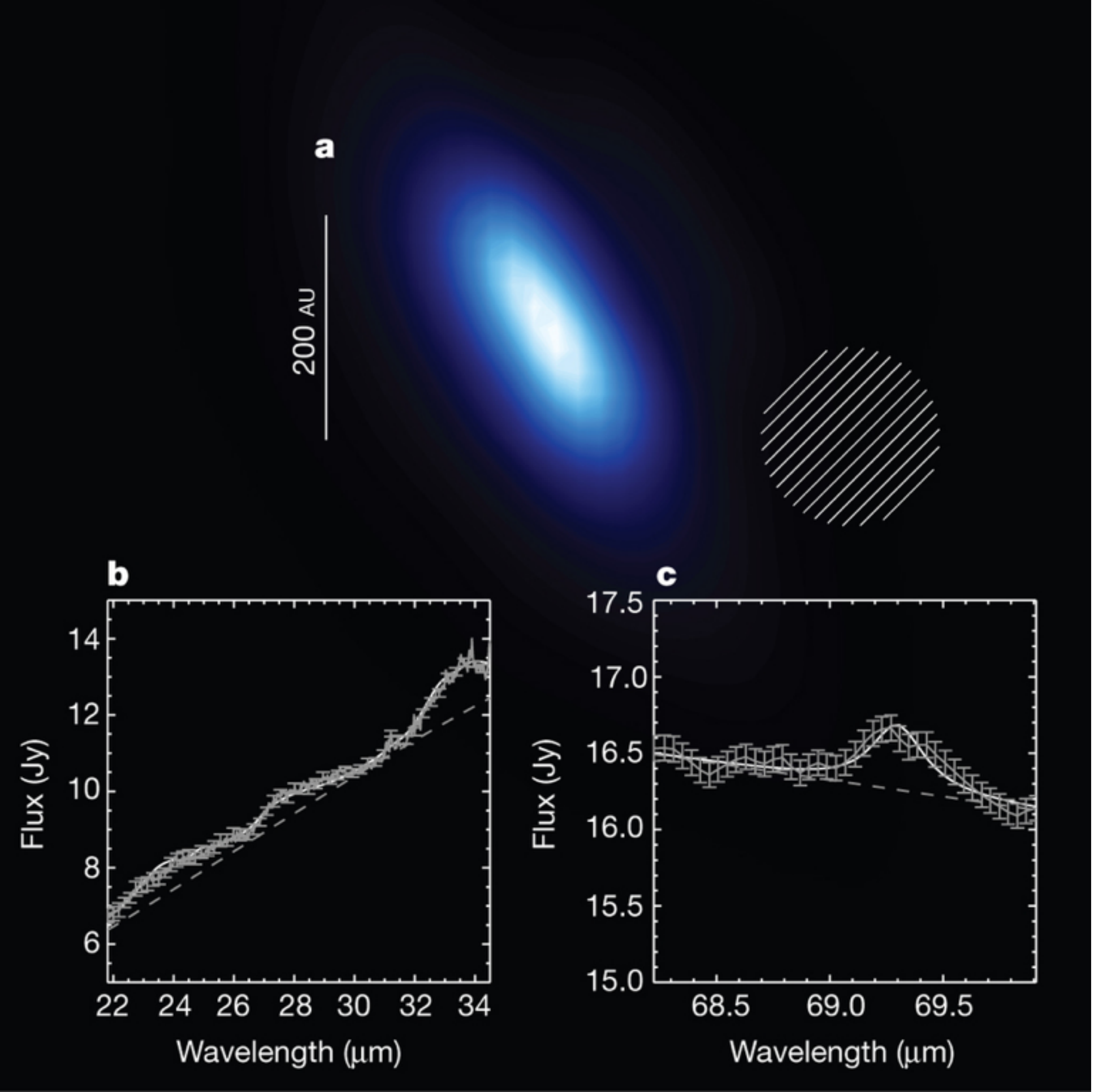


- SPICA will study the full depth of protoplanetary disks
- Water, CO, HD, ices and minerals throughout the disk

Debris Disk Mineralogy



- Debris disk spectrum at 50pc: all features detectable by SPICA



Olivine in βPic debris disk detected by Herschel: inaccessible to JWST or ALMA

de Vries+ 2012

Much more science

- Very brief overview of core science in the M5 science case
  - Not everything included by any means!
  - Whole areas eg. Solar System studies missed out
- Will see more in later talks today

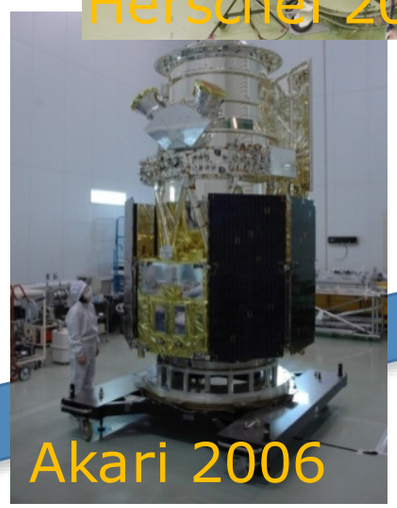
IR Astronomy: All roads lead to SPICA

IRAS 1985

ISO 1995

IRTS 1995

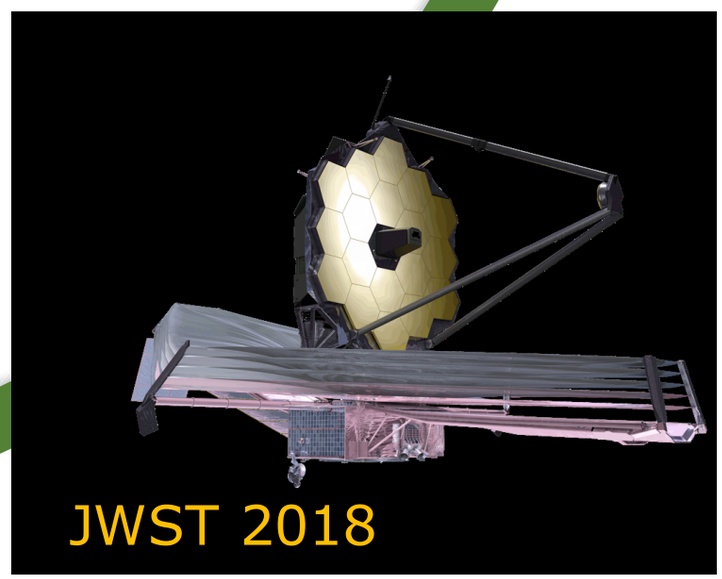
Herschel 2009-2013



Akari 2006

Spitzer 2003

SPICA!



JWST 2018