GHENT UNIVERSITY

belspo

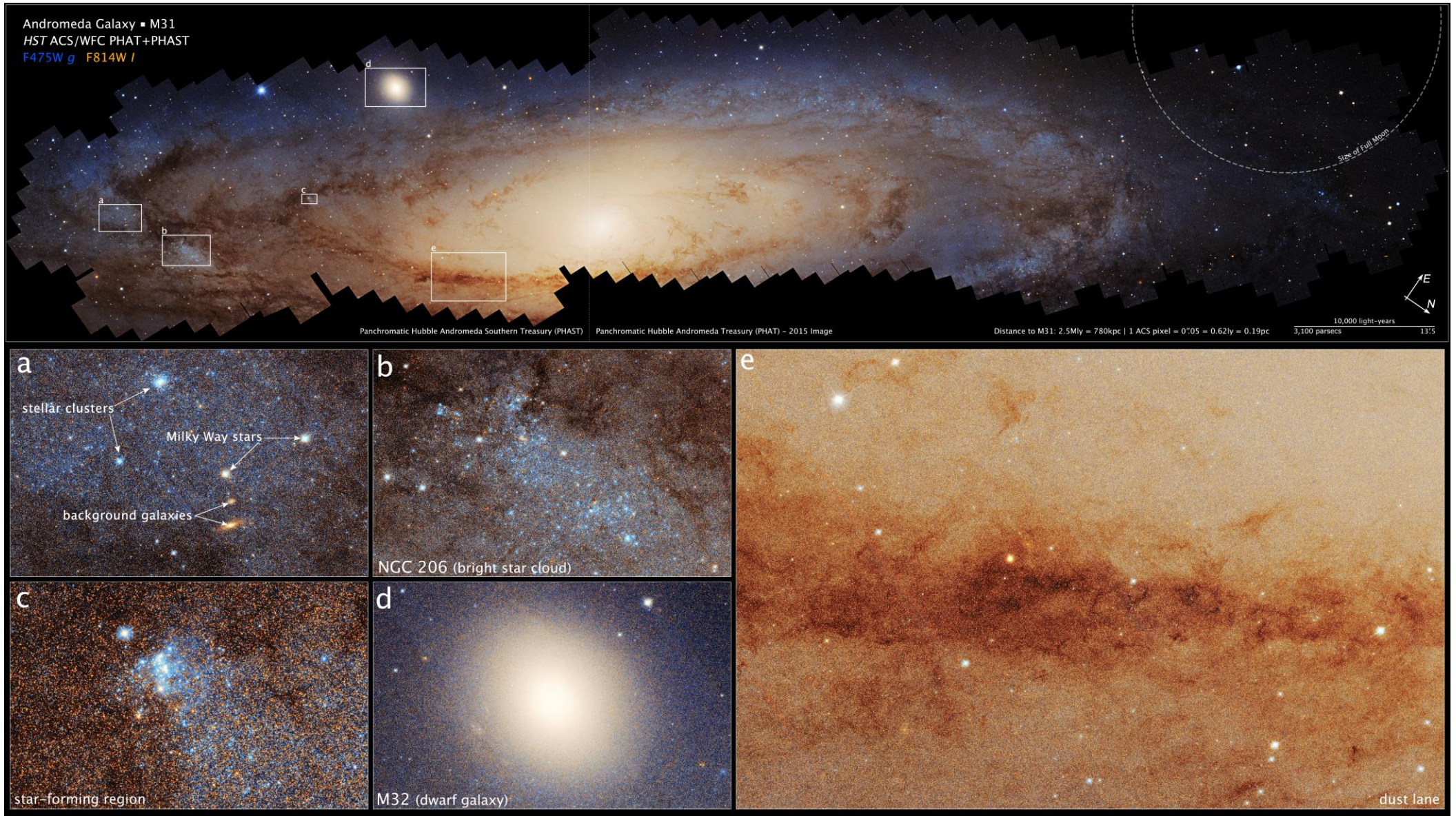
PRIMA Conference, Marseilles, France
April 1st, 2025

The radial variation of the silicate-to-carbon ratio in M31 probed by PRIMA

(or at least we hope so)

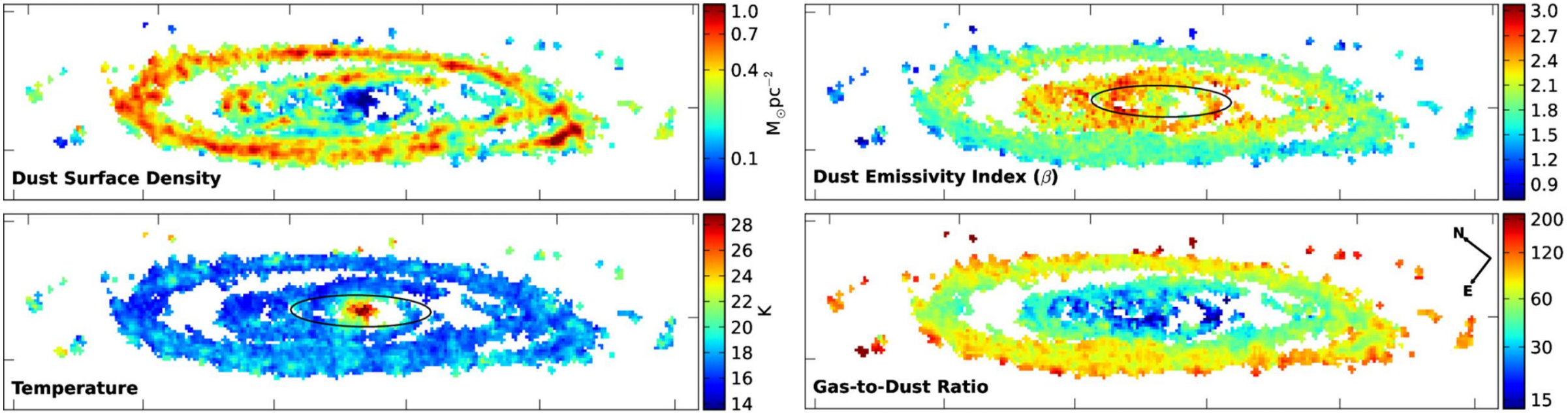
Jérémy Chastenet
and co

ANDROMEDA (M31)



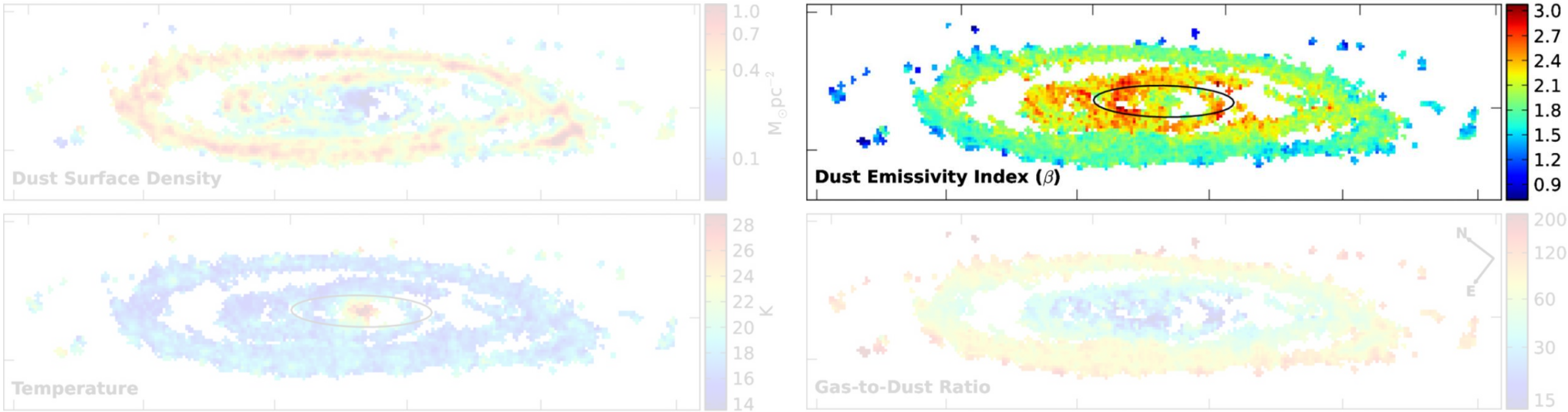
ANDROMEDA'S DUST

Modified-blackbody fits to Herschel data from Smith et al. (2012)



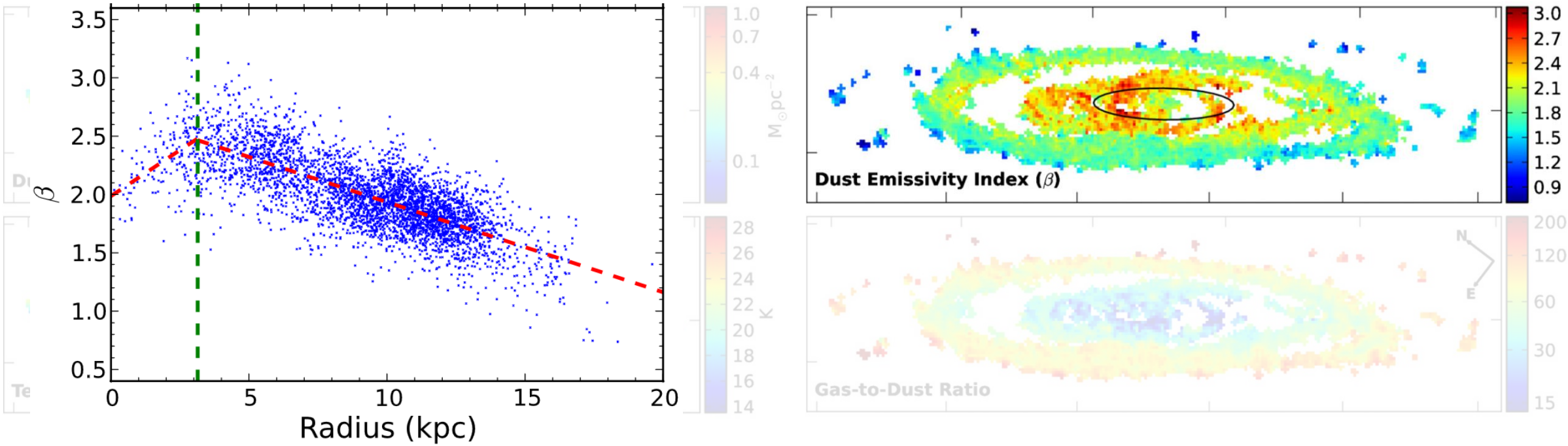
ANDROMEDA'S DUST

Modified-blackbody fits to Herschel data from Smith et al. (2012)



ANDROMEDA'S DUST

Modified-blackbody fits to Herschel data from Smith et al. (2012)



Radial variations of the spectral index β

The evolution of amorphous hydrocarbons in the ISM: dust modelling from a new vantage point

A. P. Jones[1,2], L. Fanciullo[1,2], M. Köhler[1,2], L. Verstraete[1,2], V. Guillet[1,2], M. Bocchio[1,2], and N. Ysard[1,2]

The global dust modelling framework THEMIS

A. P. Jones[1], M. Köhler[2], N. Ysard[1], M. Bocchio[1], and L. Verstraete[1]

Dust variations in the diffuse interstellar medium: constraints on Milky Way dust from *Planck*-HFI observations

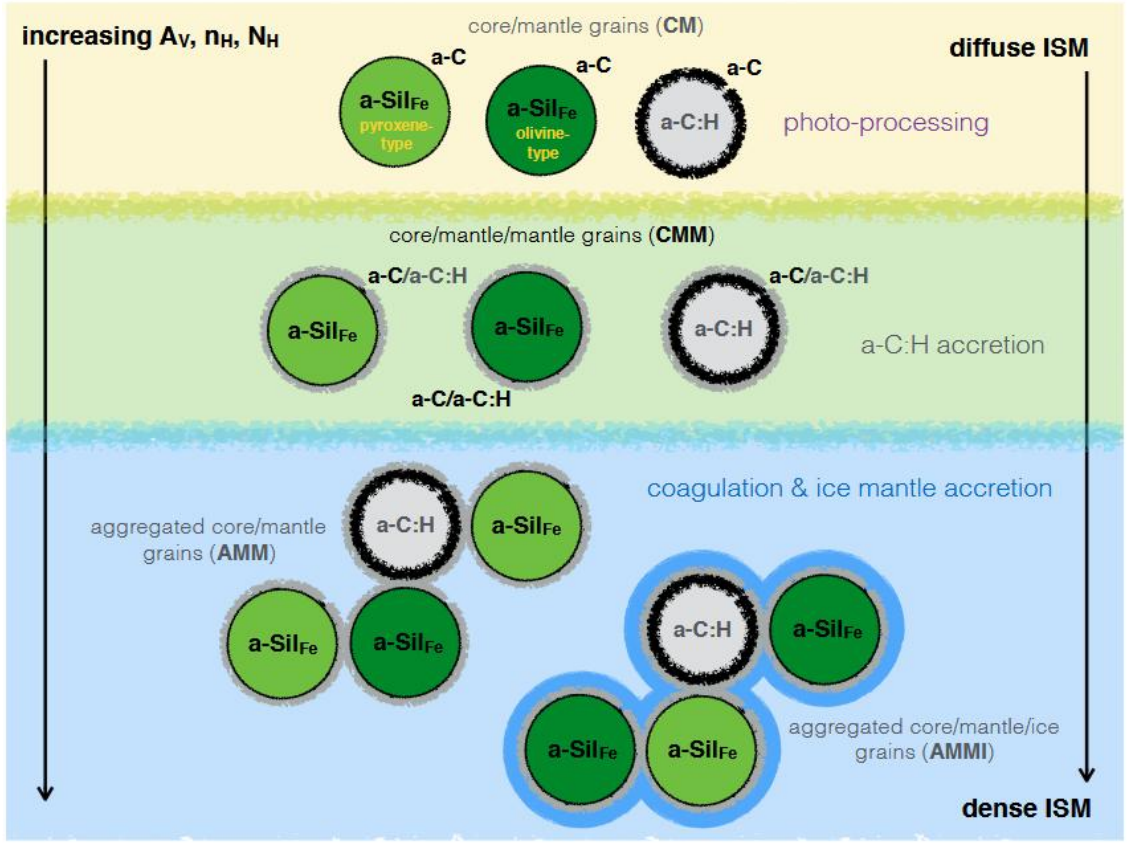
N. Ysard, M. Köhler, A. Jones, M.-A. Miville-Deschênes, A. Abergel, and L. Fanciullo

A hidden reservoir of Fe/FeS in interstellar silicates?

M. Köhler, A. Jones, and N. Ysard

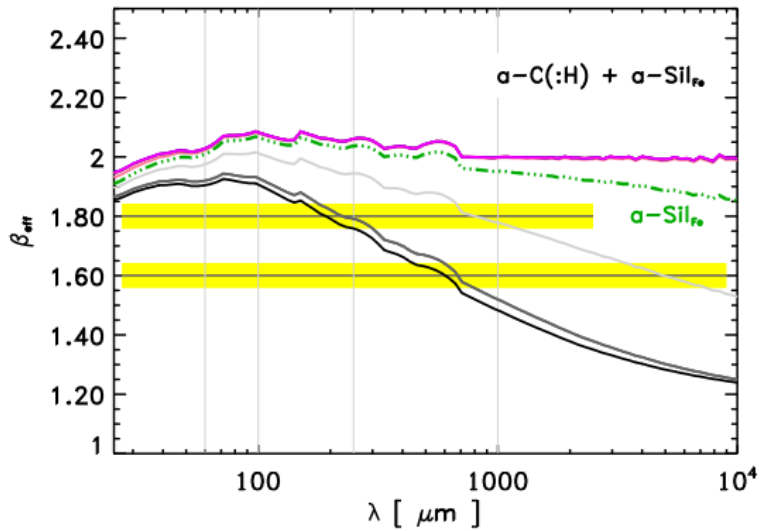
Dust evolution in the transition towards the denser ISM: impact on dust temperature, opacity, and spectral index

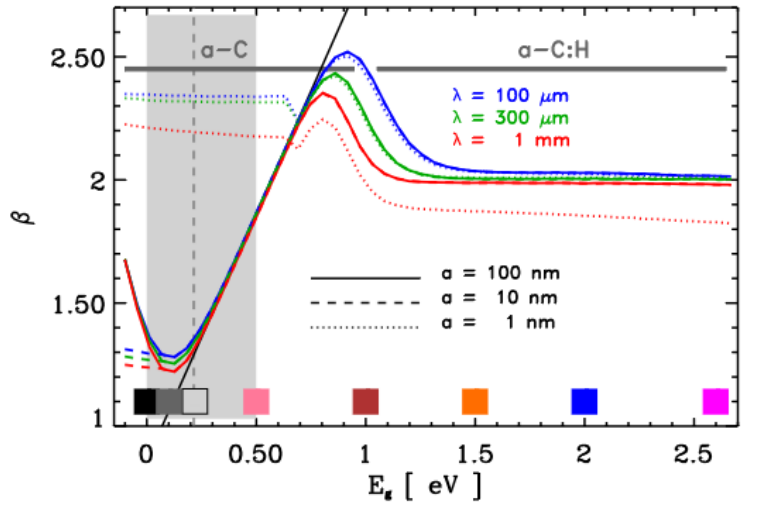
M. Köhler, N. Ysard, and A. P. Jones



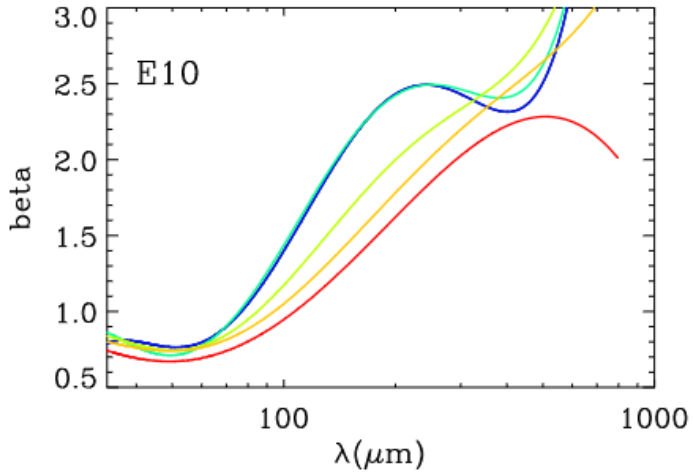
SPECTRAL INDEX MODELING AND LAB DATA

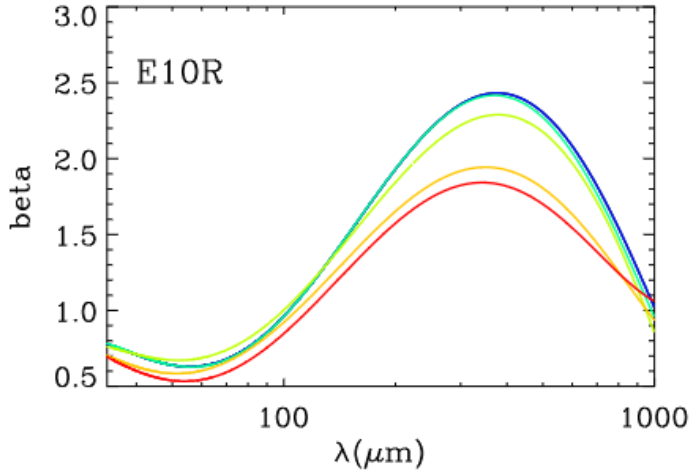
Jones et al. (2013)





Demyk et al. (2017)





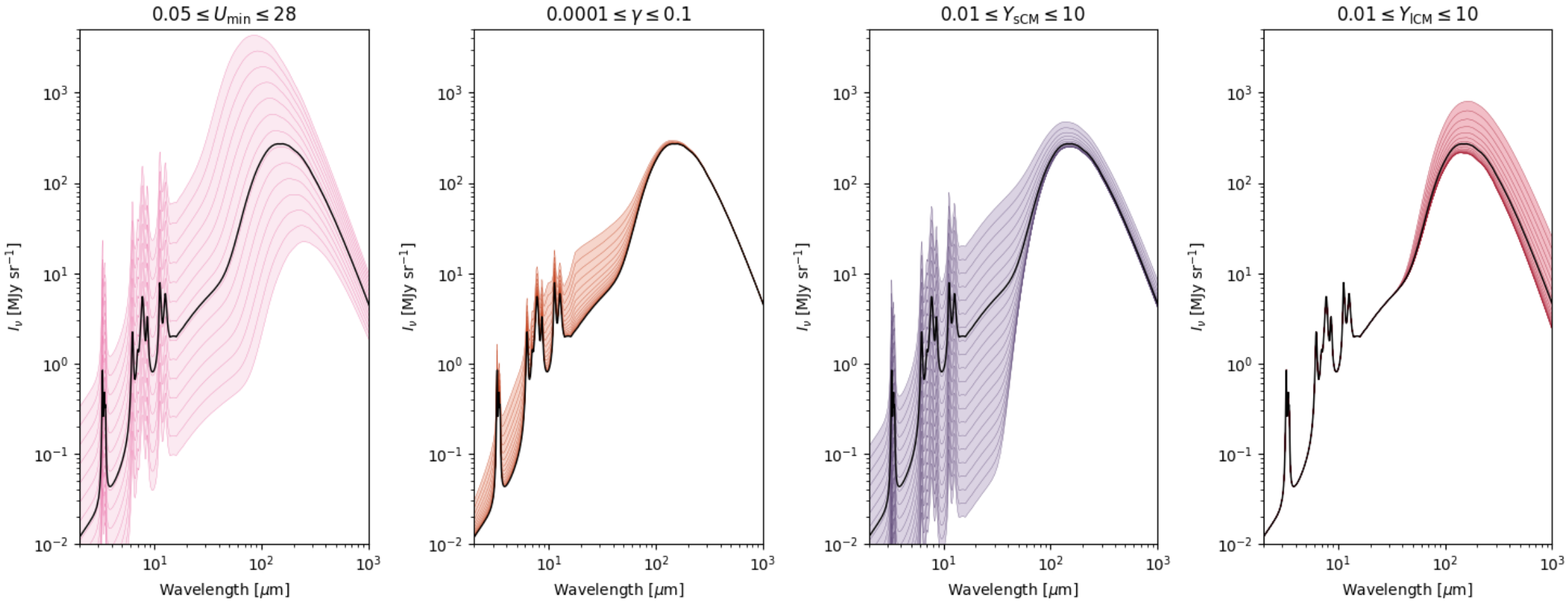
PARAMETERIZATION IN THEMIS

- Radiation field components:
  - U_{min} – the minimum radiation field heating the dust grain
  - γ – the fraction of dust mass heated by a power-law integrated range of increasing radiation field (power-law index set to 2, maximum radiation field intensity set to 10^7)
- Dust surface densities, three grain populations:
  - Y_{sCM20} – abundance of small carbon grains
  - Y_{lCM20} – abundance of large carbon grains
  - Y_{aSil} – abundance of large amorphous silicate grains

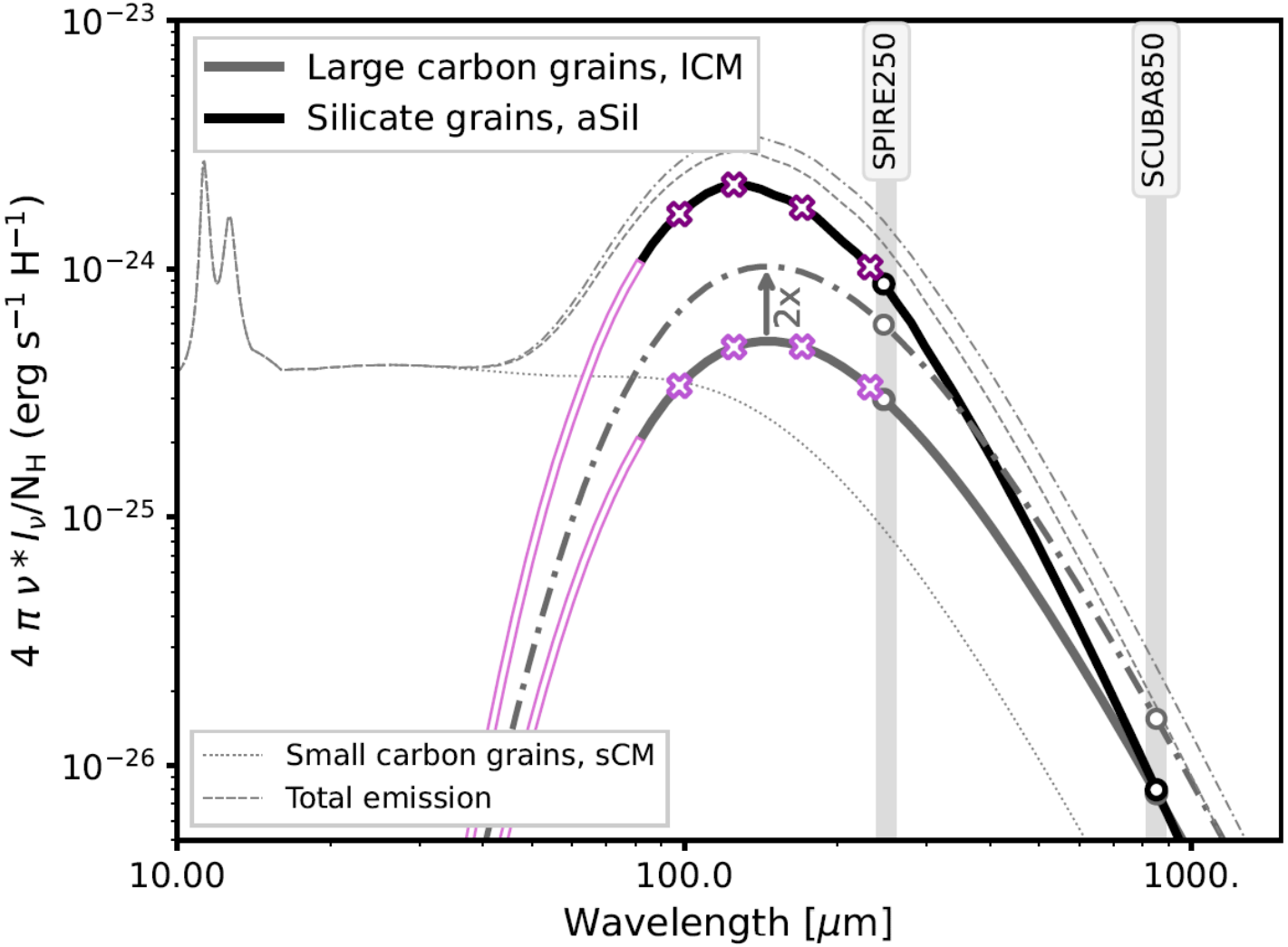
$$R_{aSil/aC} = Y_{aSil}/Y_{lCM20}$$

Can we measure variations in the carbon-to-silicate ratio using IR dust emission fitting?

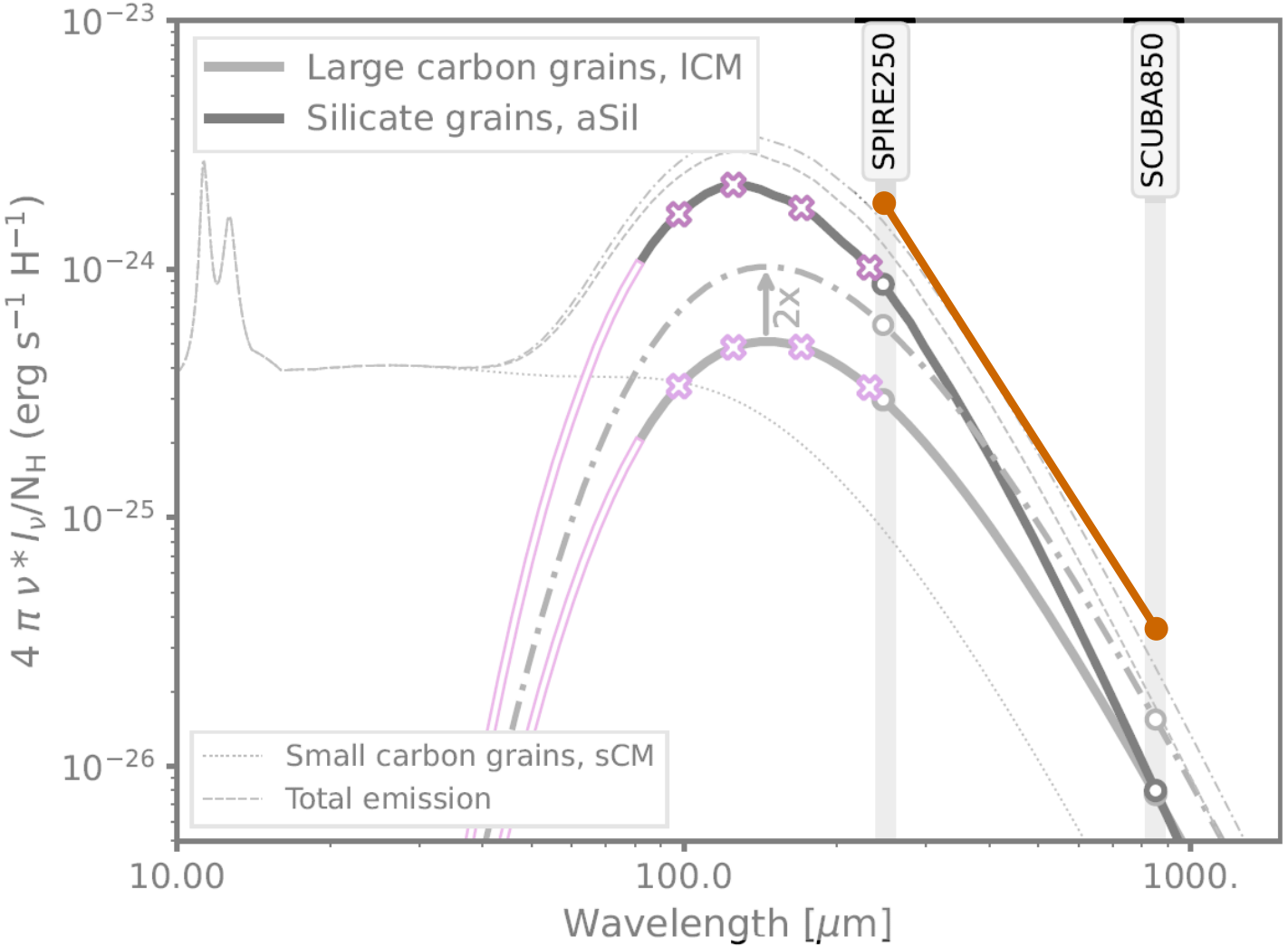
PARAMETERIZATION IN THEMIS



STARTING POINT: FAR-IR VARIATIONS

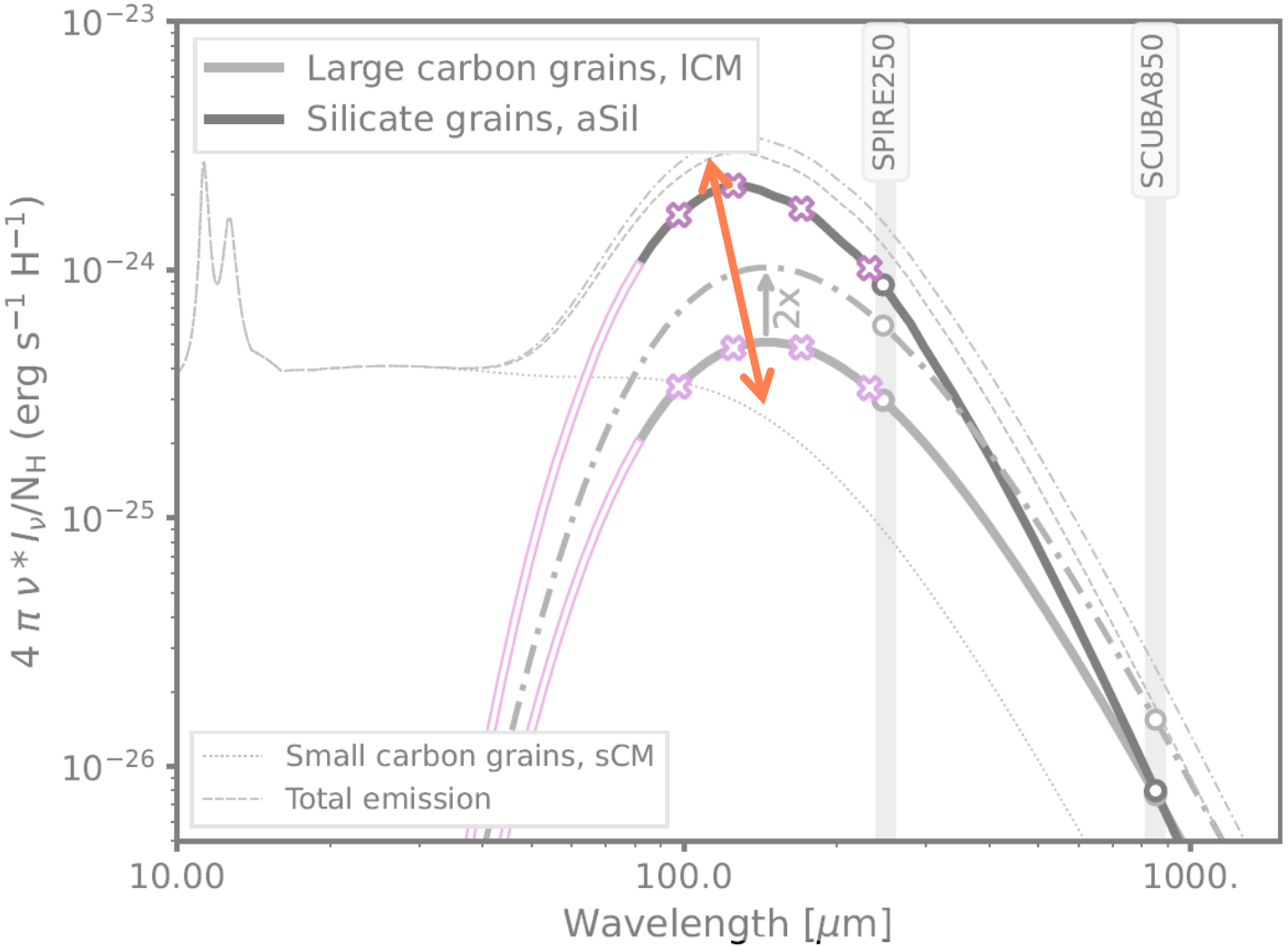


STARTING POINT: FAR-IR VARIATIONS



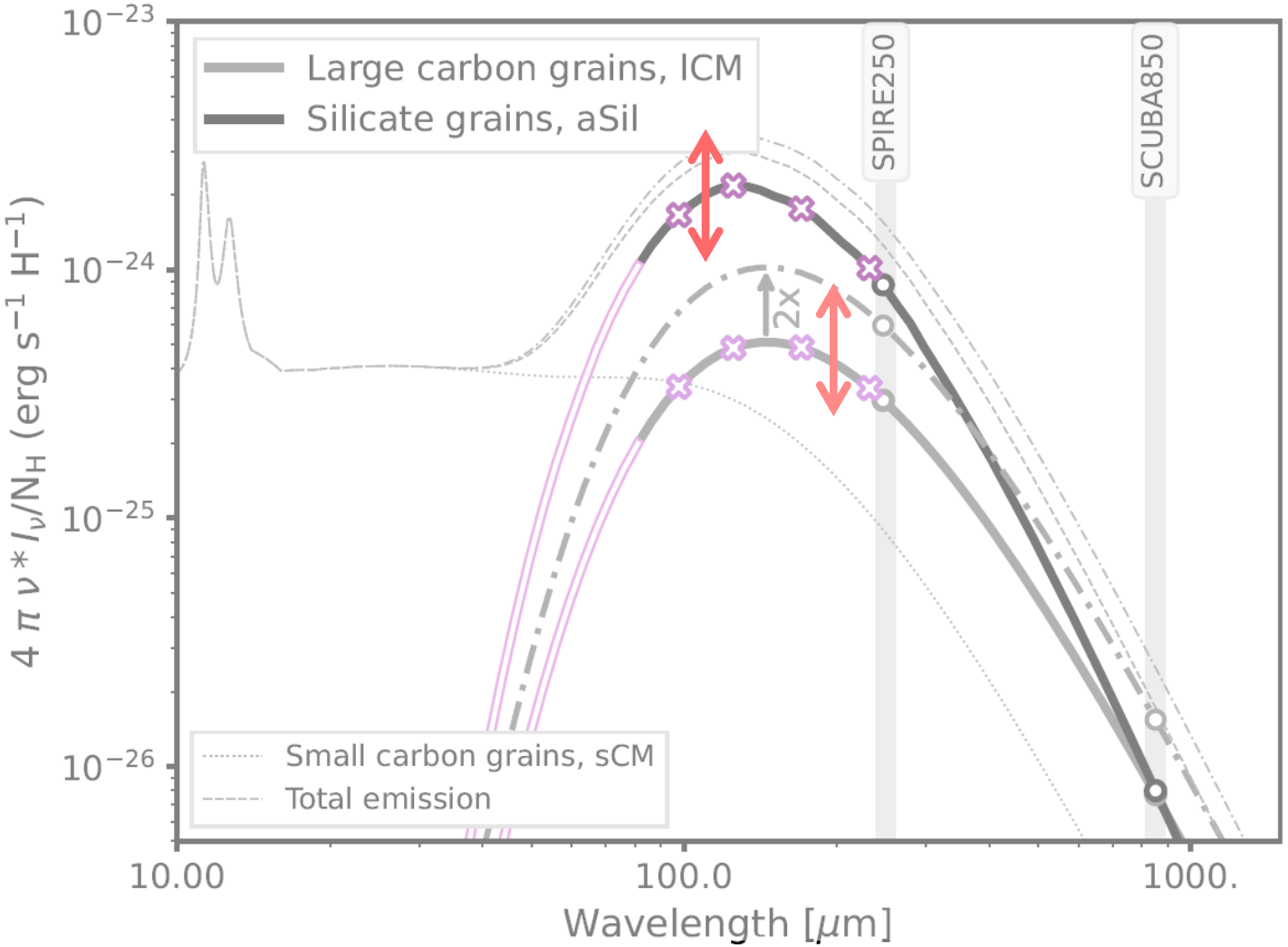
- Use the SPIRE250 / SCUBA850 as a ‘far-IR slope’ tracer

STARTING POINT: FAR-IR VARIATIONS



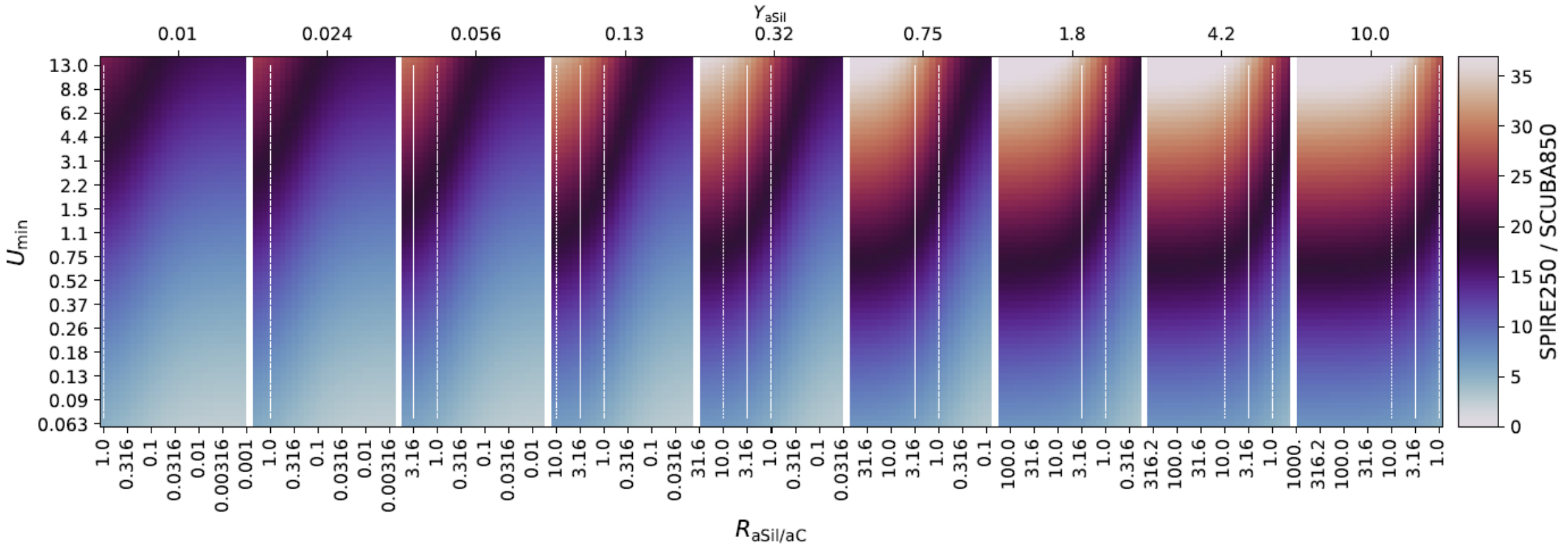
- Use the SPIRE250 / SCUBA850 as a 'far-IR slope' tracer
- Vary the minimum radiation field U_{min}

STARTING POINT: FAR-IR VARIATIONS

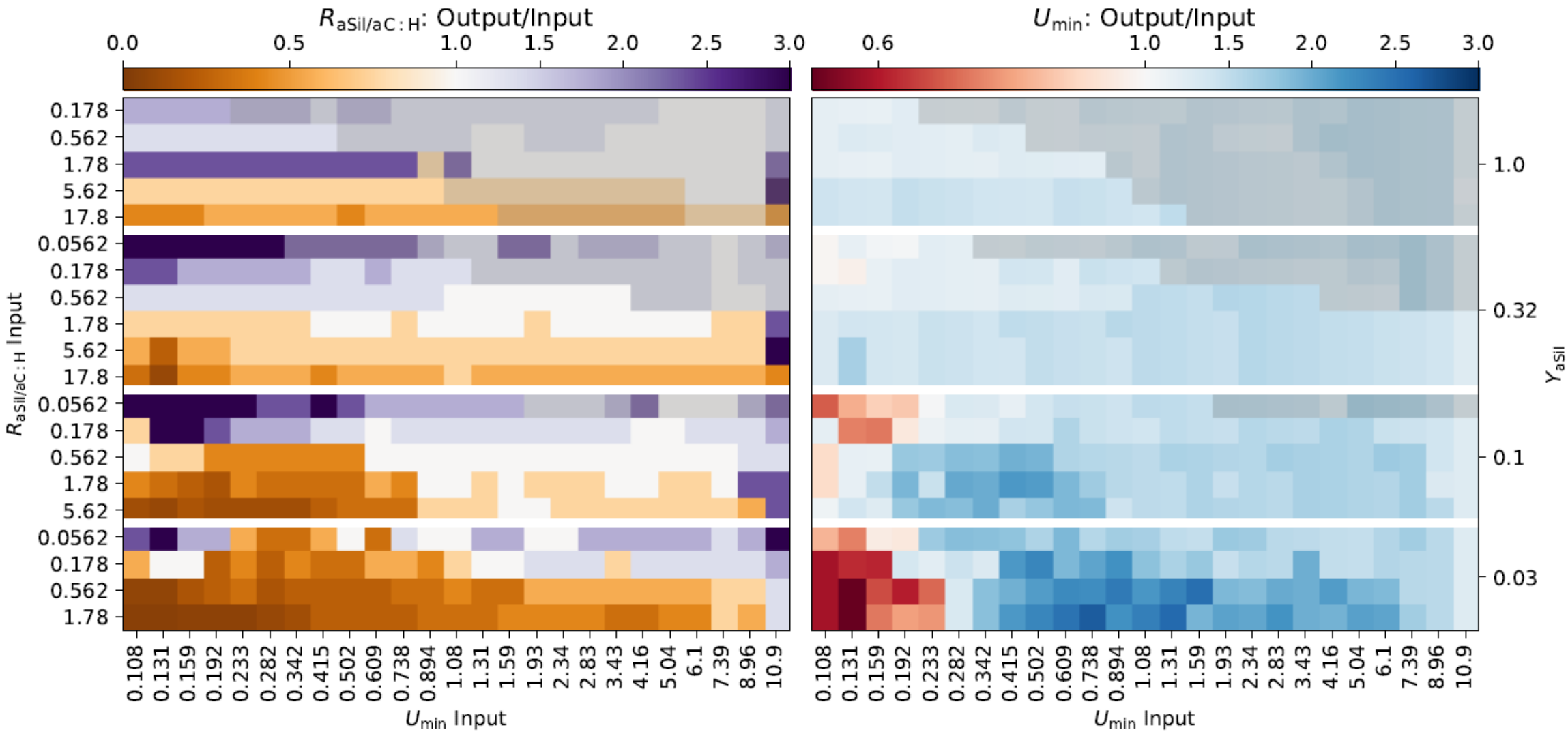


- Use the SPIRE250 / SCUBA850 as a 'far-IR slope' tracer
- Vary the minimum radiation field U_{min}
- Independently vary Y_{aSil} and Y_{lCM20}, and compute the $R_{aSil/aC}$

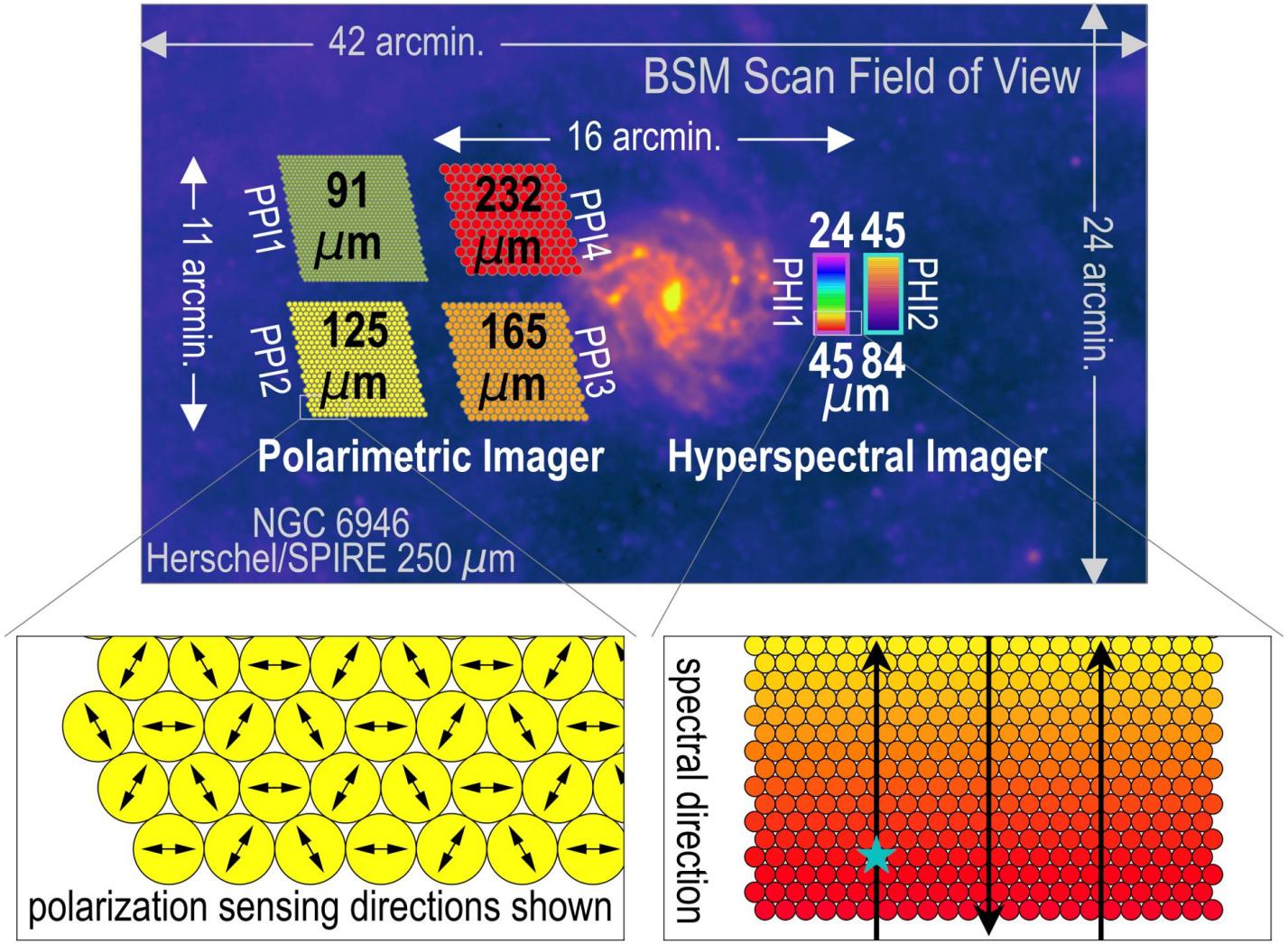
A COMPLEX PROBLEM



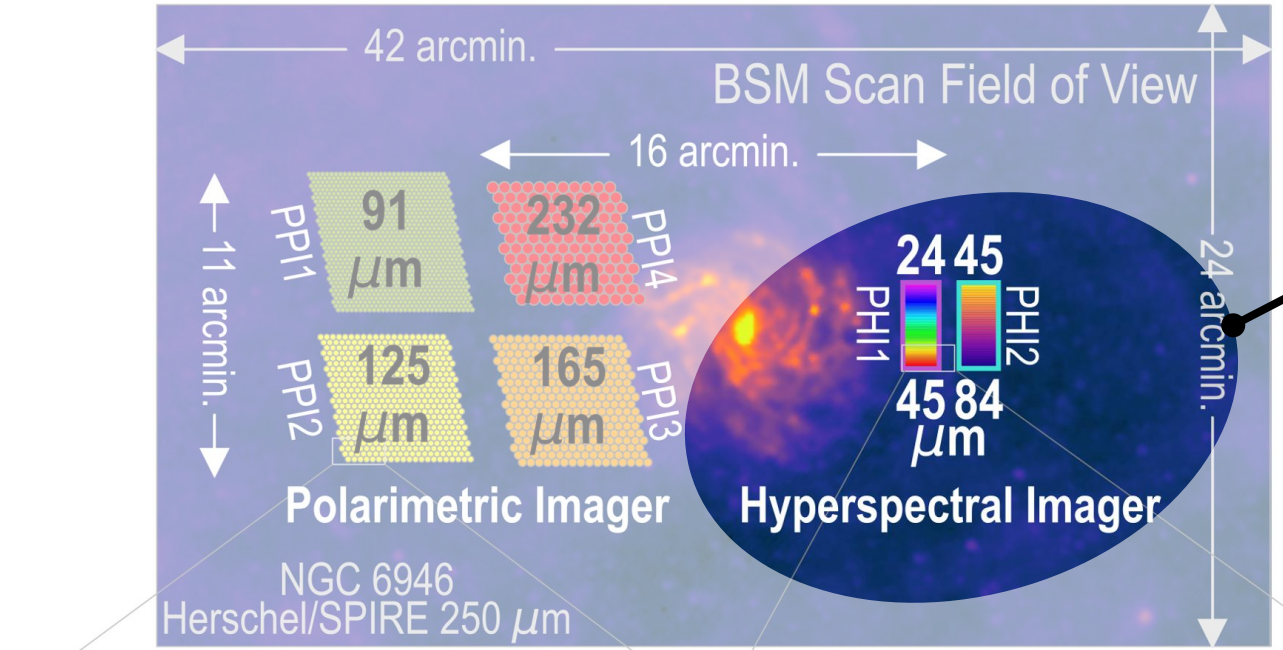
FITTING QUALITY

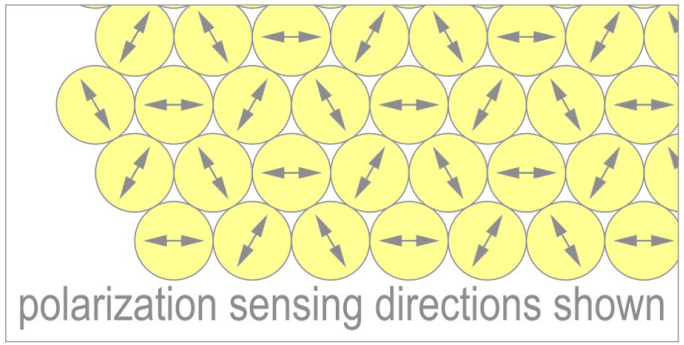


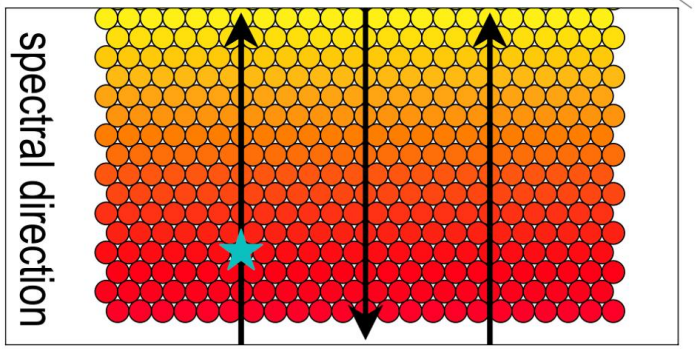
PRIMAGER


42 arcmin.
BSM Scan Field of View
16 arcmin.
11 arcmin.
24 arcmin.
91 μm
PPI1
232 μm
PPI4
125 μm
PPI2
165 μm
PPI3
24 45
PHI1
PHI2
45 84 μm
Polarimetric Imager
Hyperspectral Imager
NGC 6946
Herschel/SPIRE 250 μm
polarization sensing directions shown
spectral direction

PRIMAGER



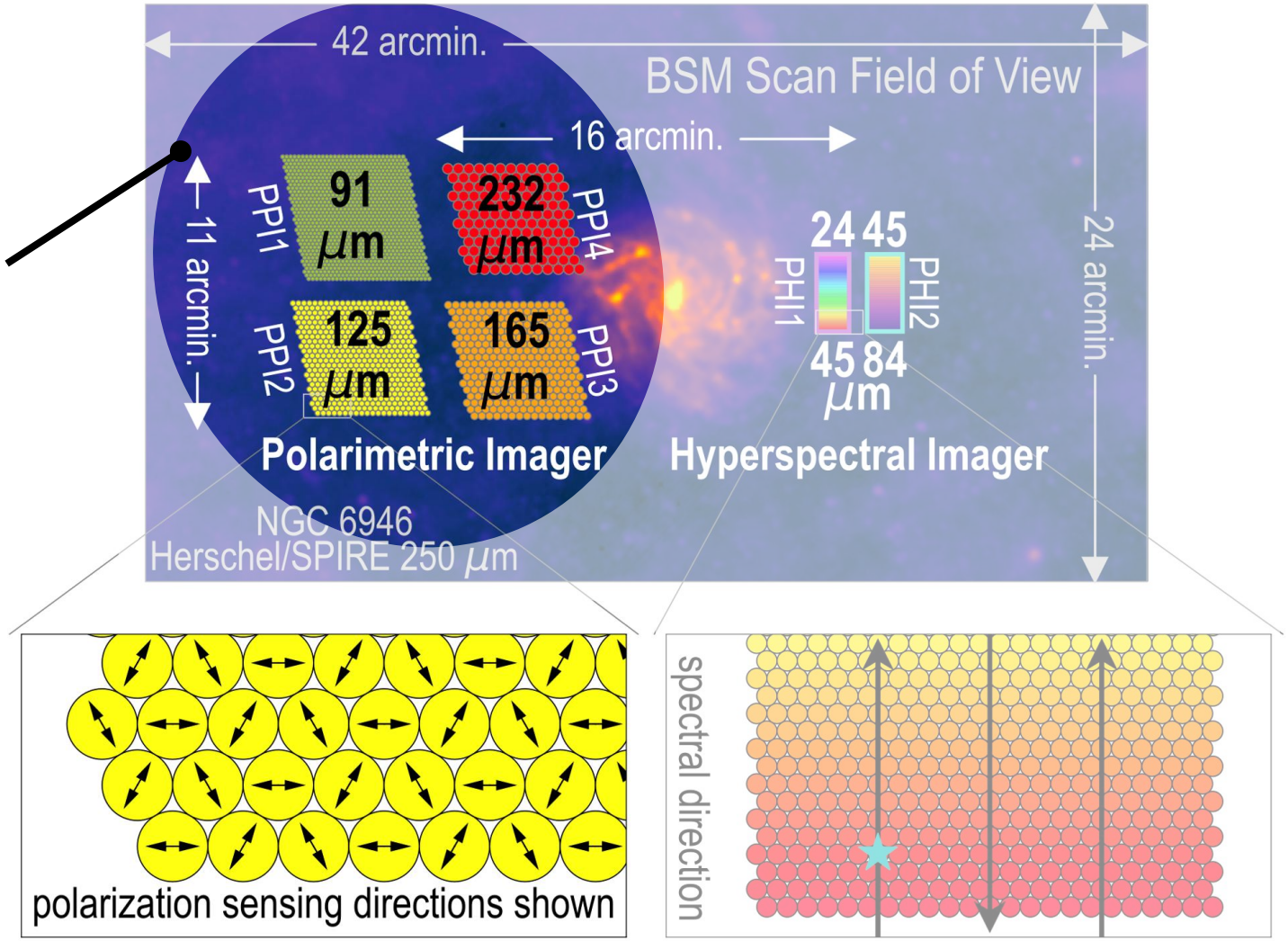




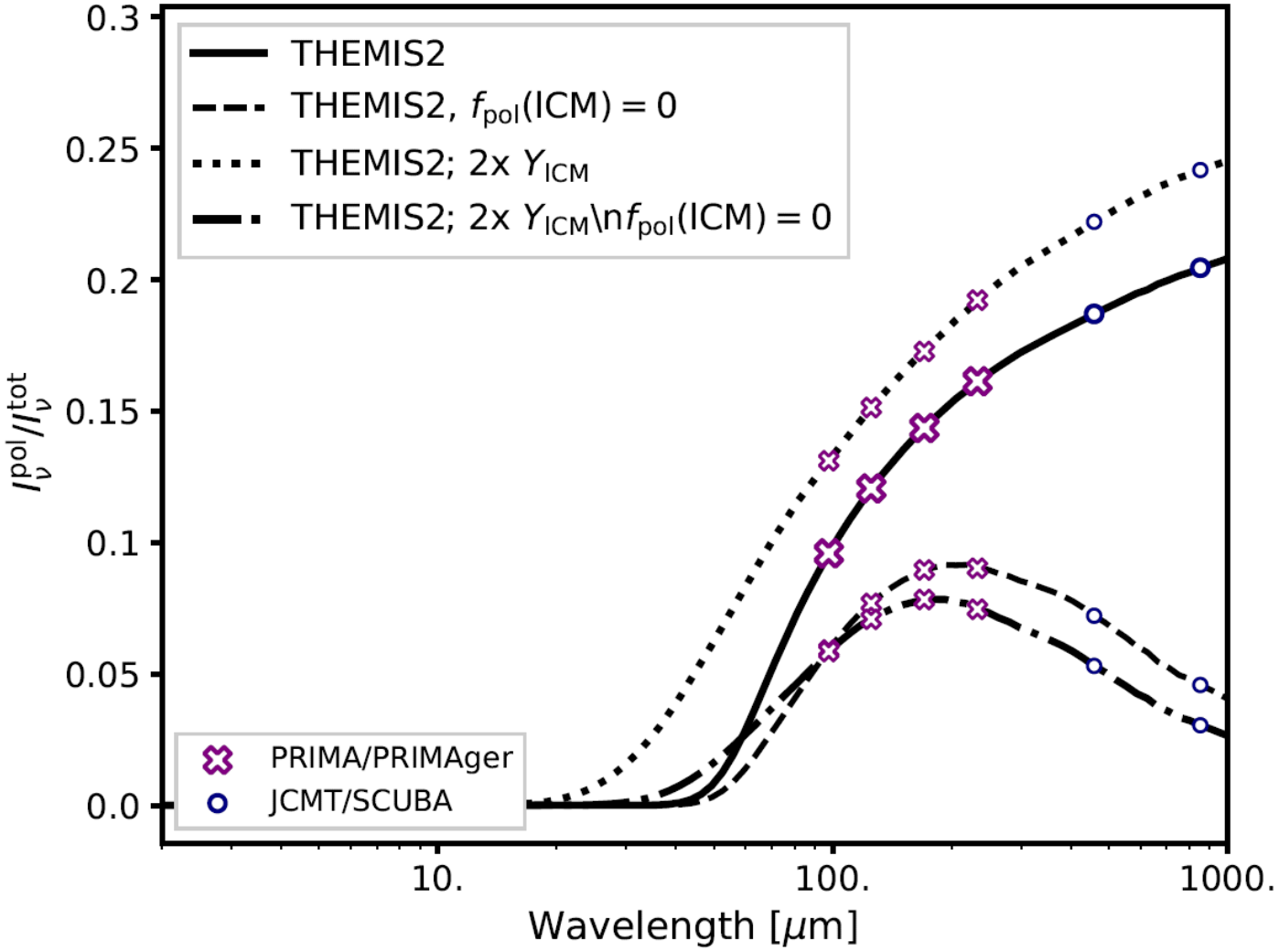
Help constrain γ, and the radiation field

PRIMAGER

Help constrain the relative abundance of silicate grains and carbon grains



PRIMAGER: A POLARIZED BRIGHT FUTURE



- In Andromeda (M31), there are radial variations of the dust spectral index β
  - work done with Herschel data → can we use SCUBA-2 data for a better fit?

- Using THEMIS, we look at the variations of the far-IR slope 250 µm / 850 µm
  - as a function of radiation field, Umin
  - as a function of the silicate-to-carbon ratio
  - as a function of the abundance of silicate (or carbon) grains

→These are relatively degenerate quantities in IR dust emission fitting

- With PRIMAger, we anticipate to mitigate these issues with polarization measurements, and a (much) better sampling of the 20–80 µm range.