Andromeda in all colours

Dust scaling relations at sub-kpc resolution

Sébastien Viaene
and the HELGA team:

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UNIVERSITEIT GENT

Why we like M31:

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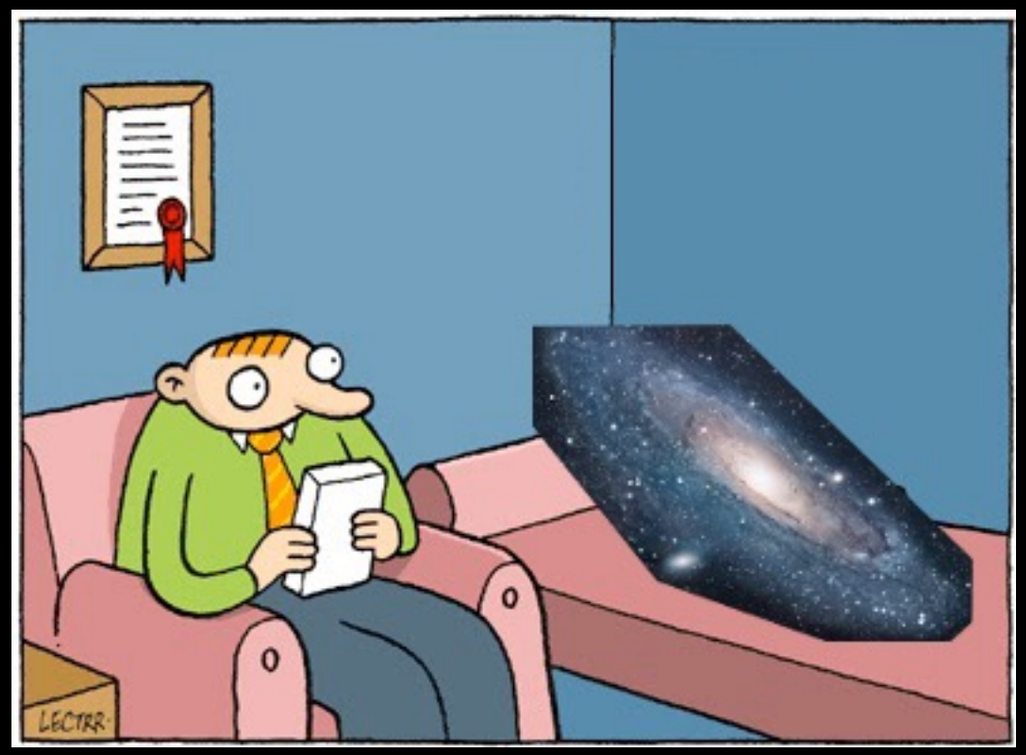
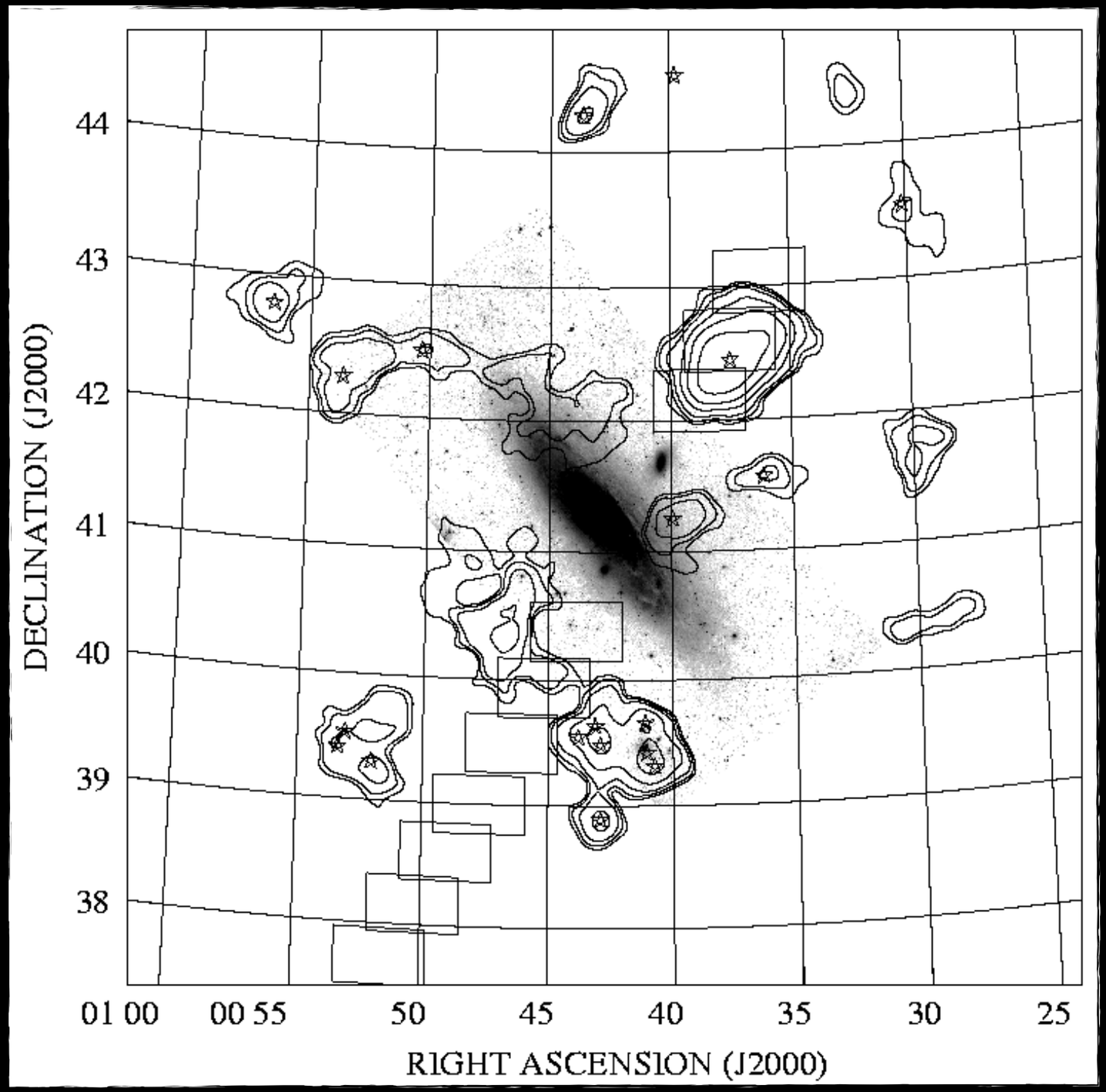
- Signs of a troubled past

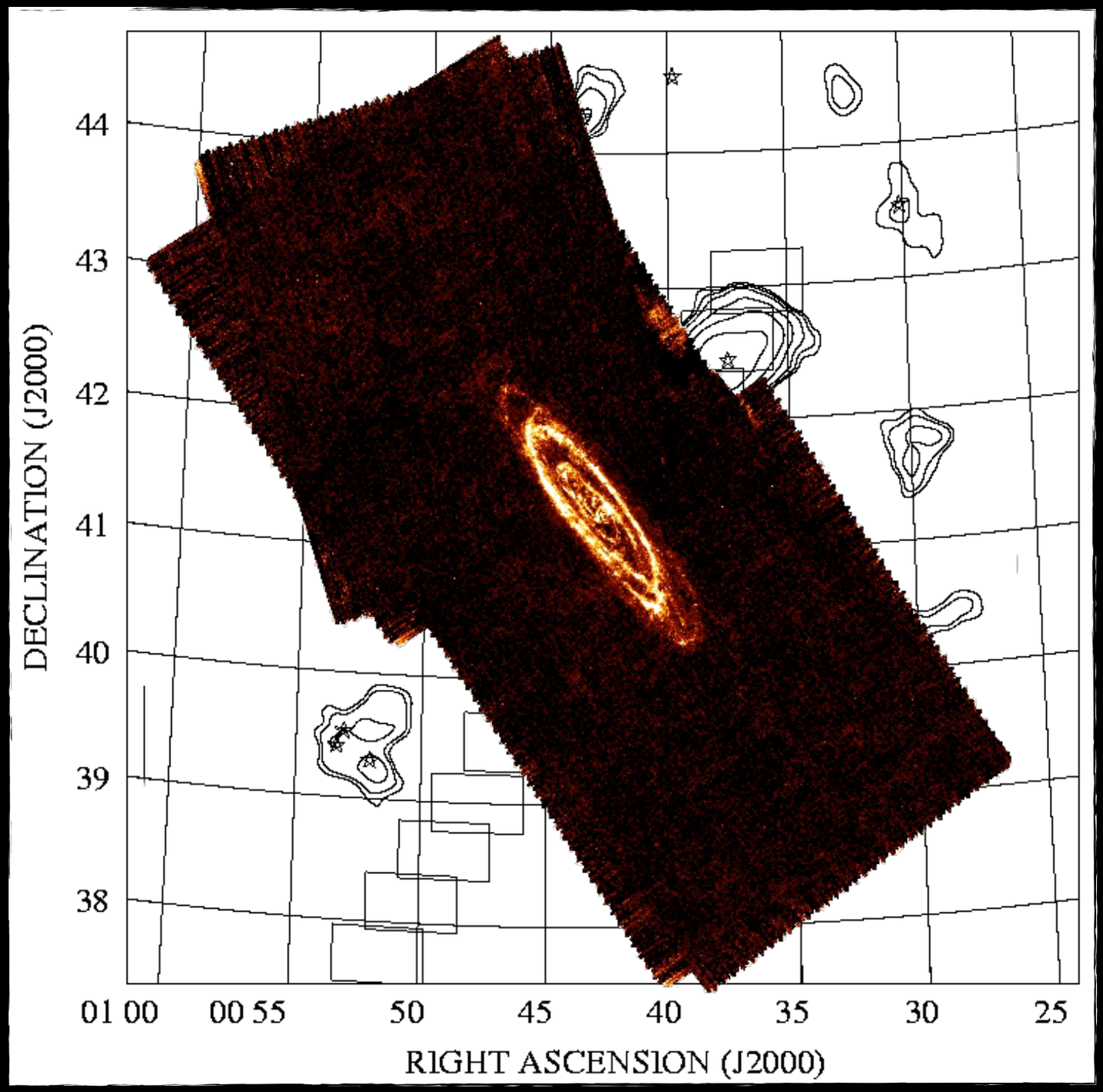


Herschel Exploitation of Local Galaxy Andromeda



HI + optical
Thilker et al. (2004)

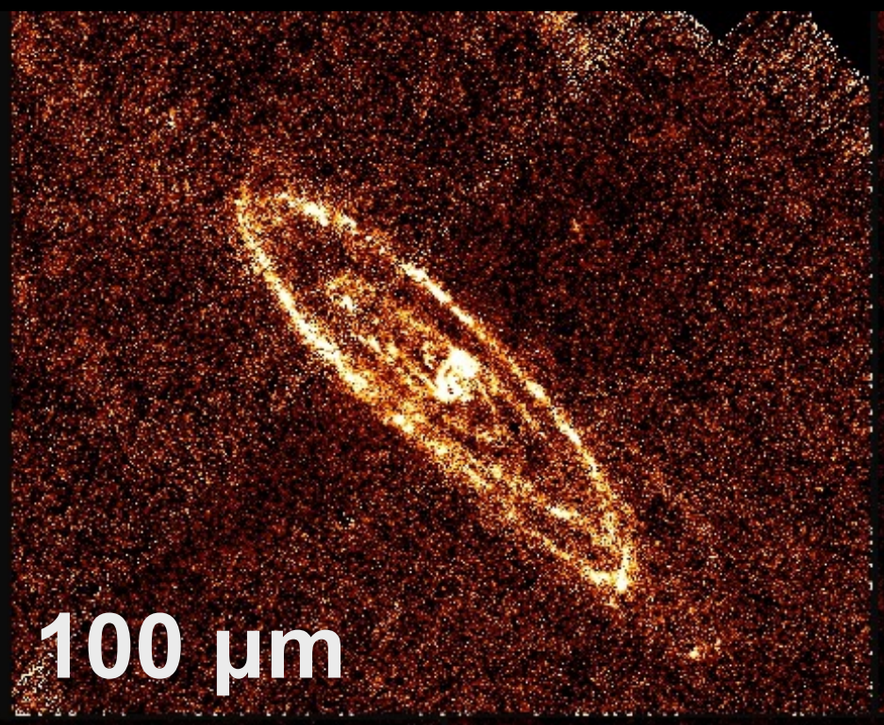
Herschel Exploitation of Local Galaxy Andromeda

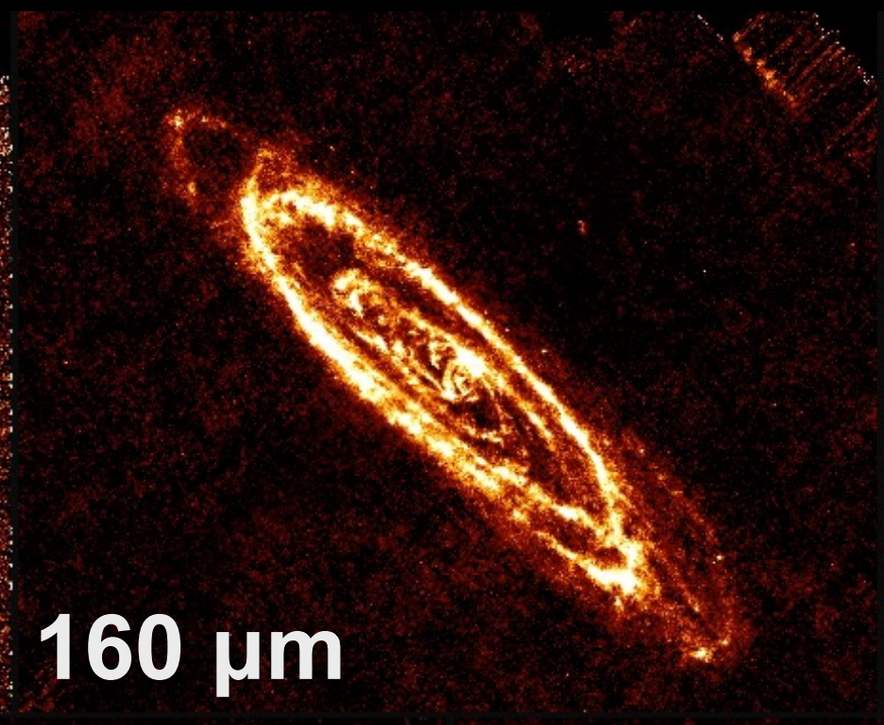


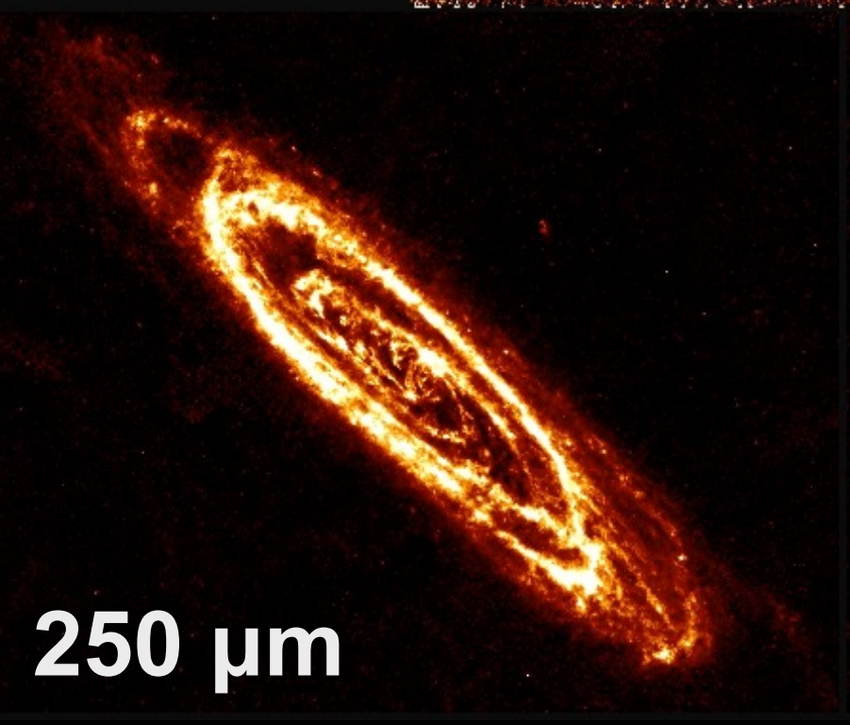
PACS 160 μm
Fritz et al. (2012)

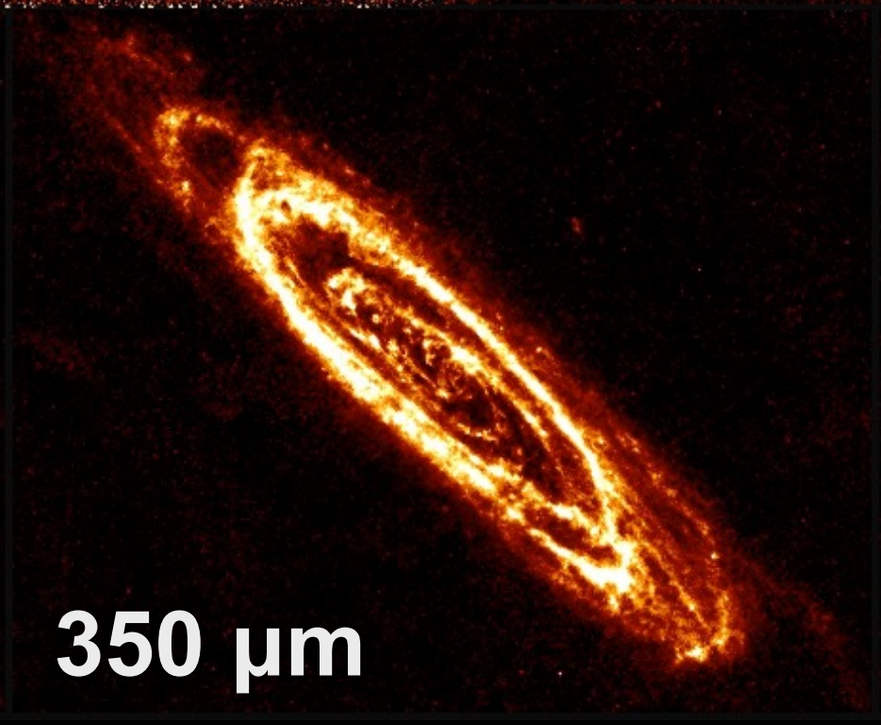
HELGA: Dataset

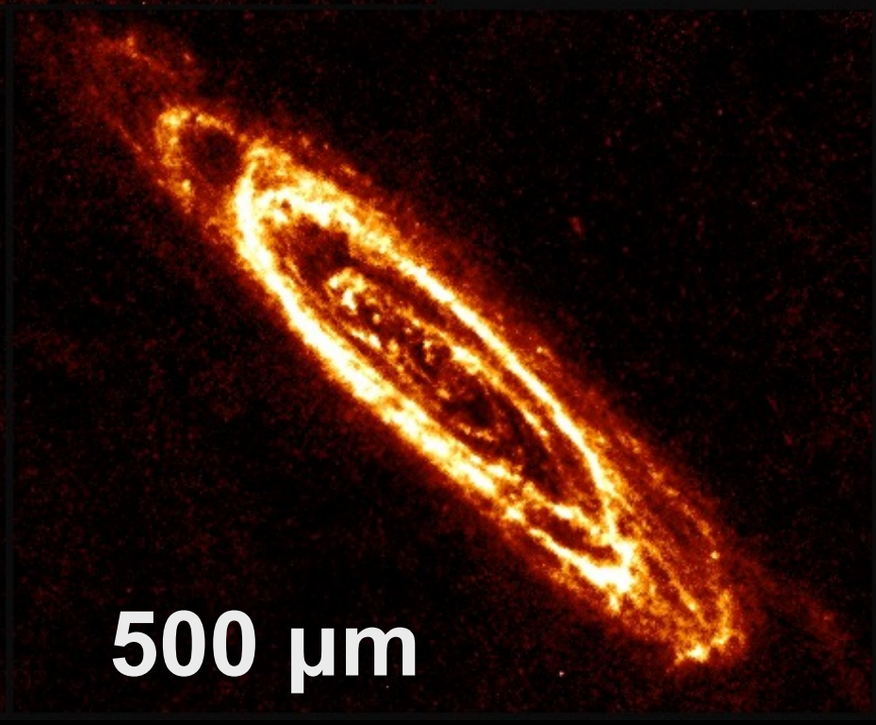
Modelling the panchromatic SED of M31





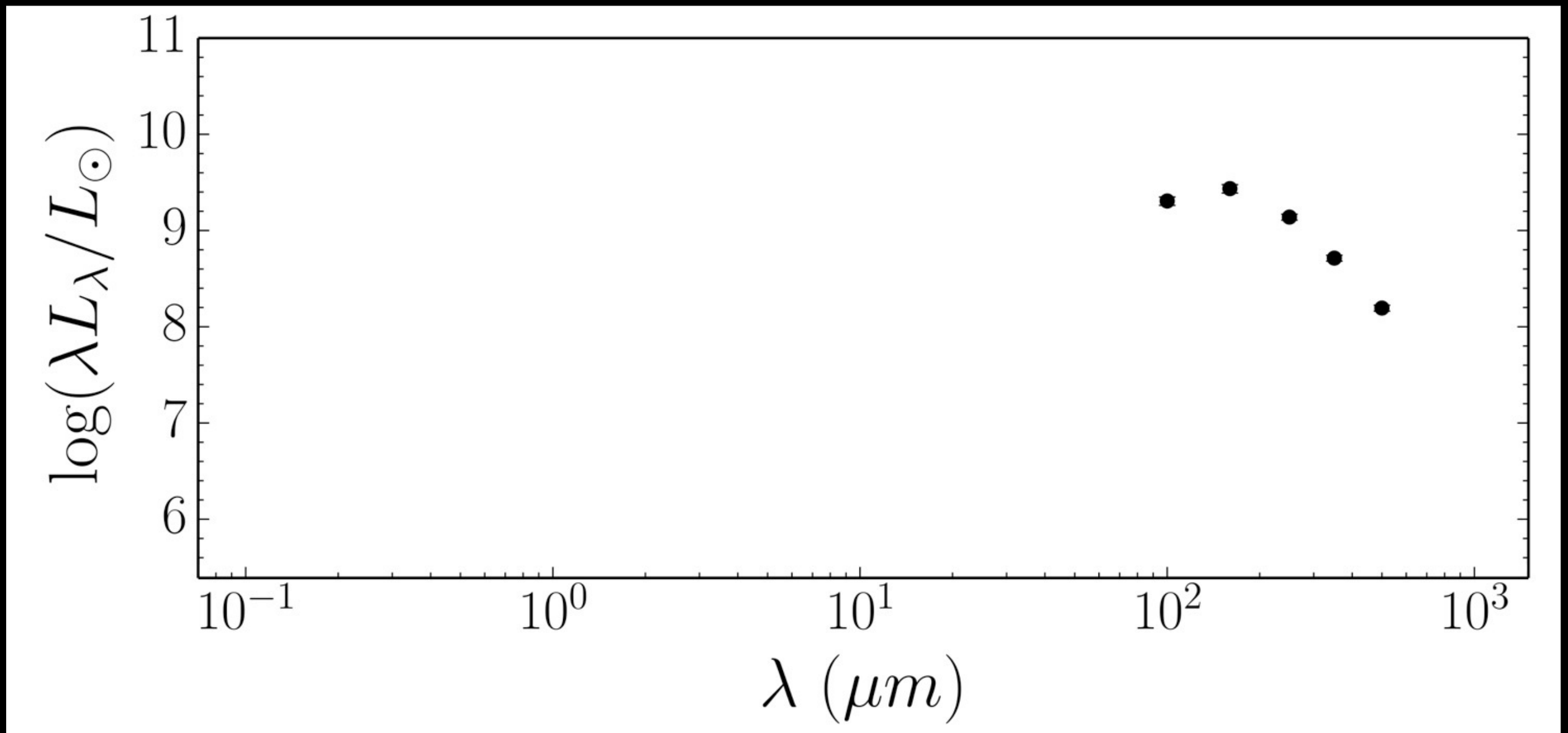






HELGA: Herschel maps

- Cold dust emission



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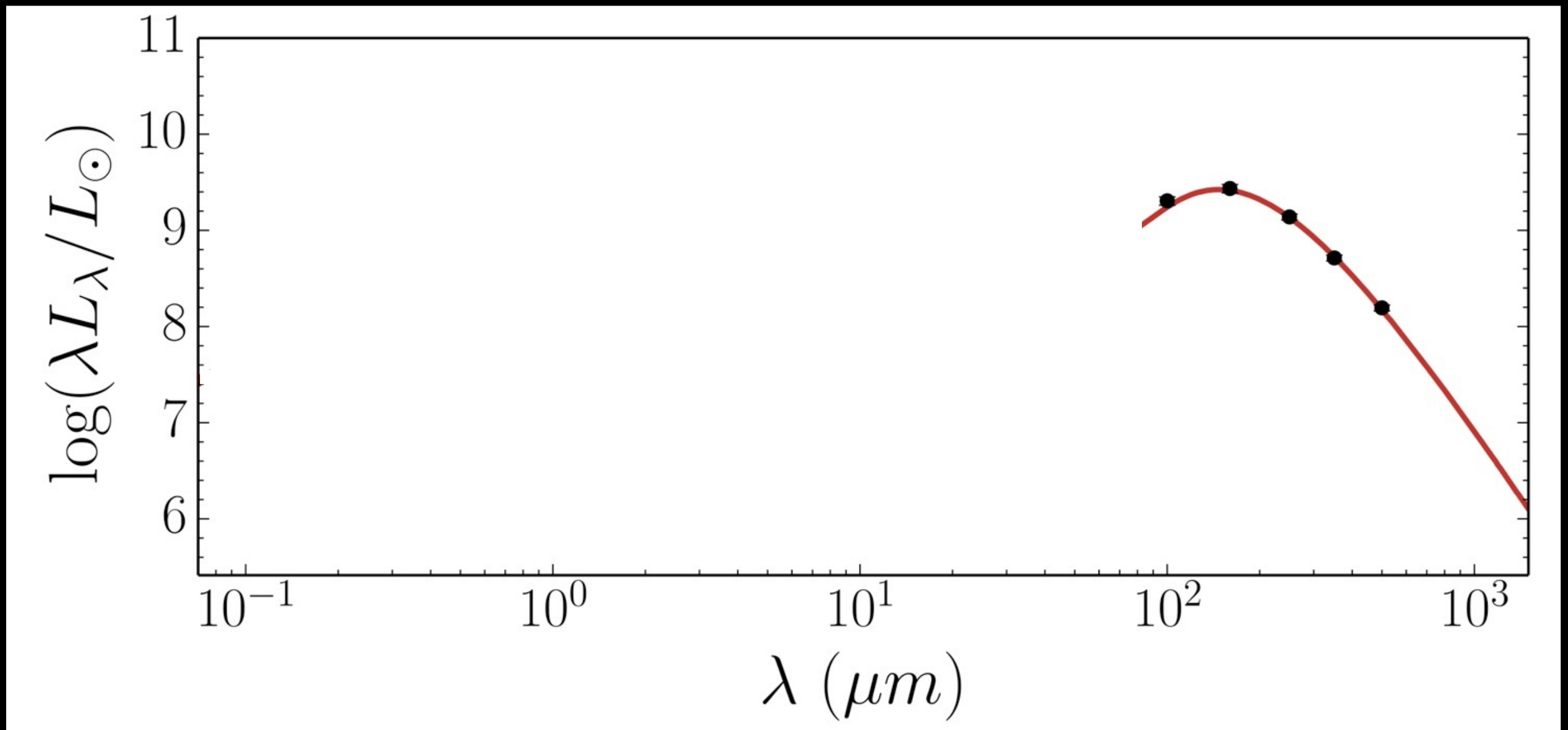
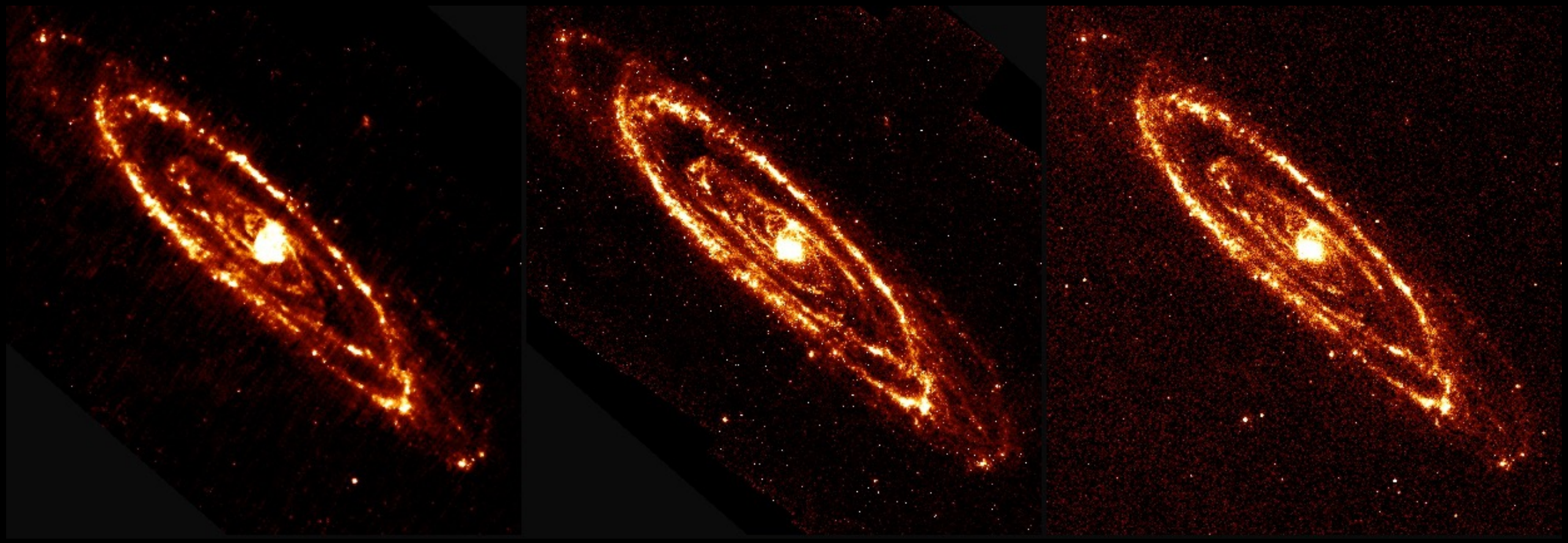


HELGA: FIR maps

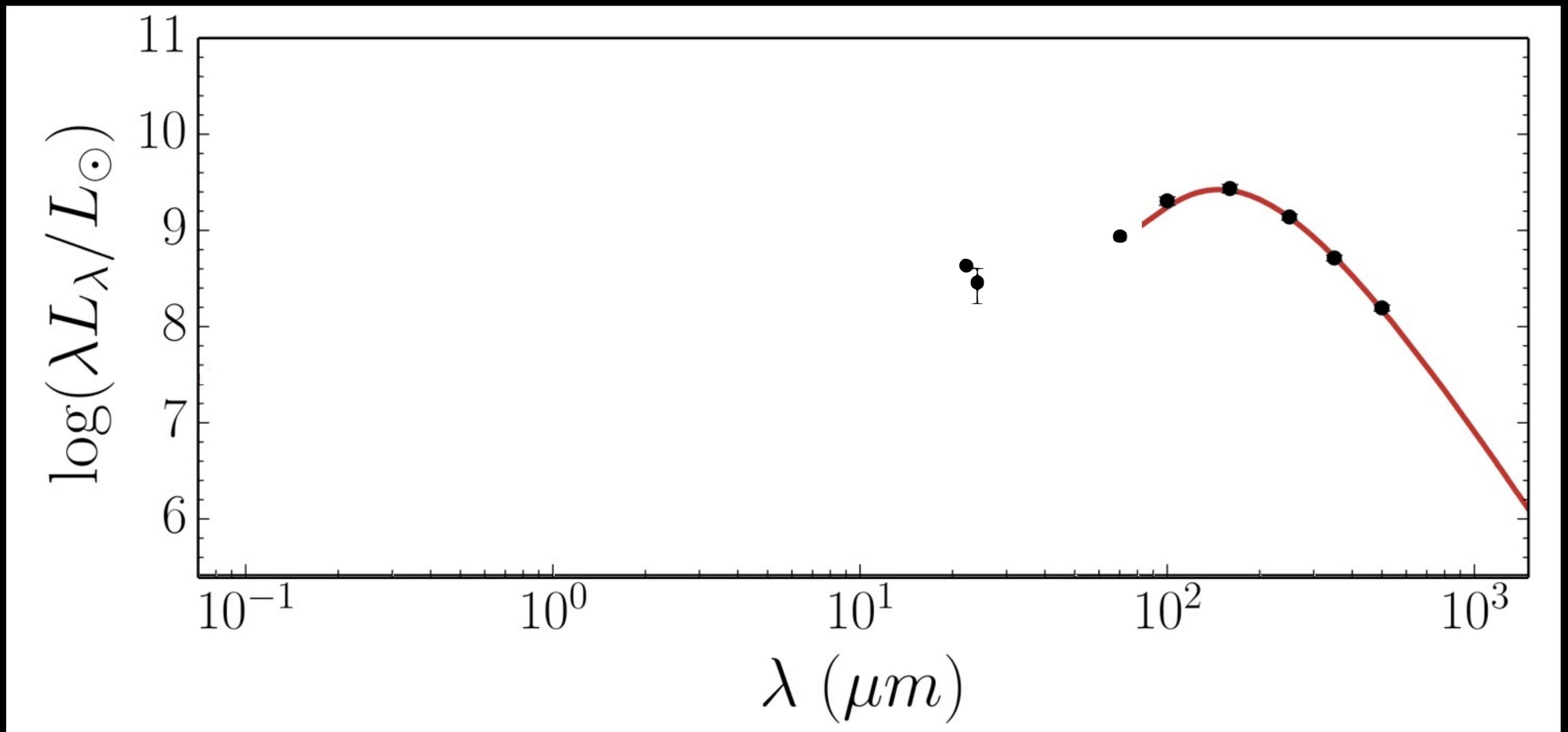


MIPS 70 μm **MIPS 24 μm** **WISE 22 μm**

K. Gordon, T. Jarrett

HELGA: FIR maps

- Warm dust emission



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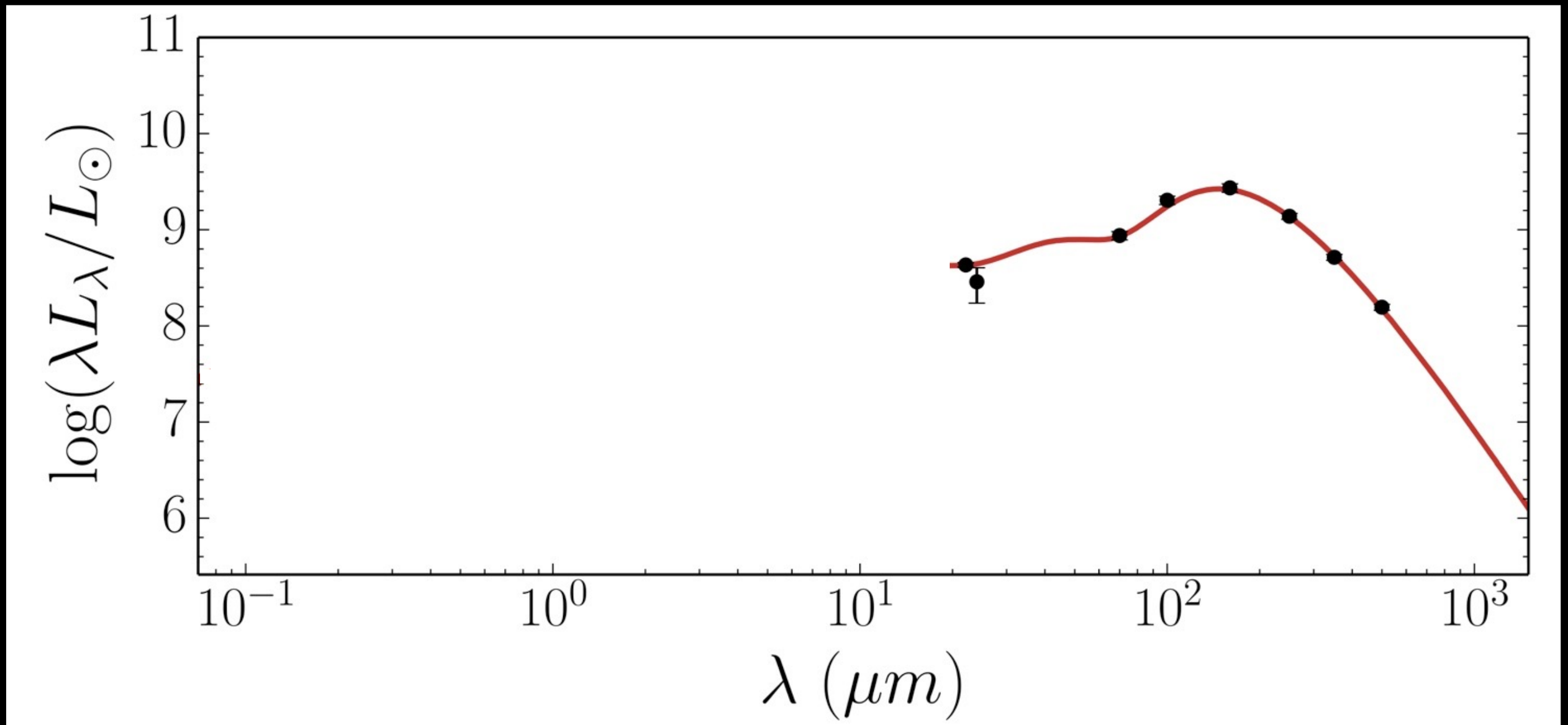
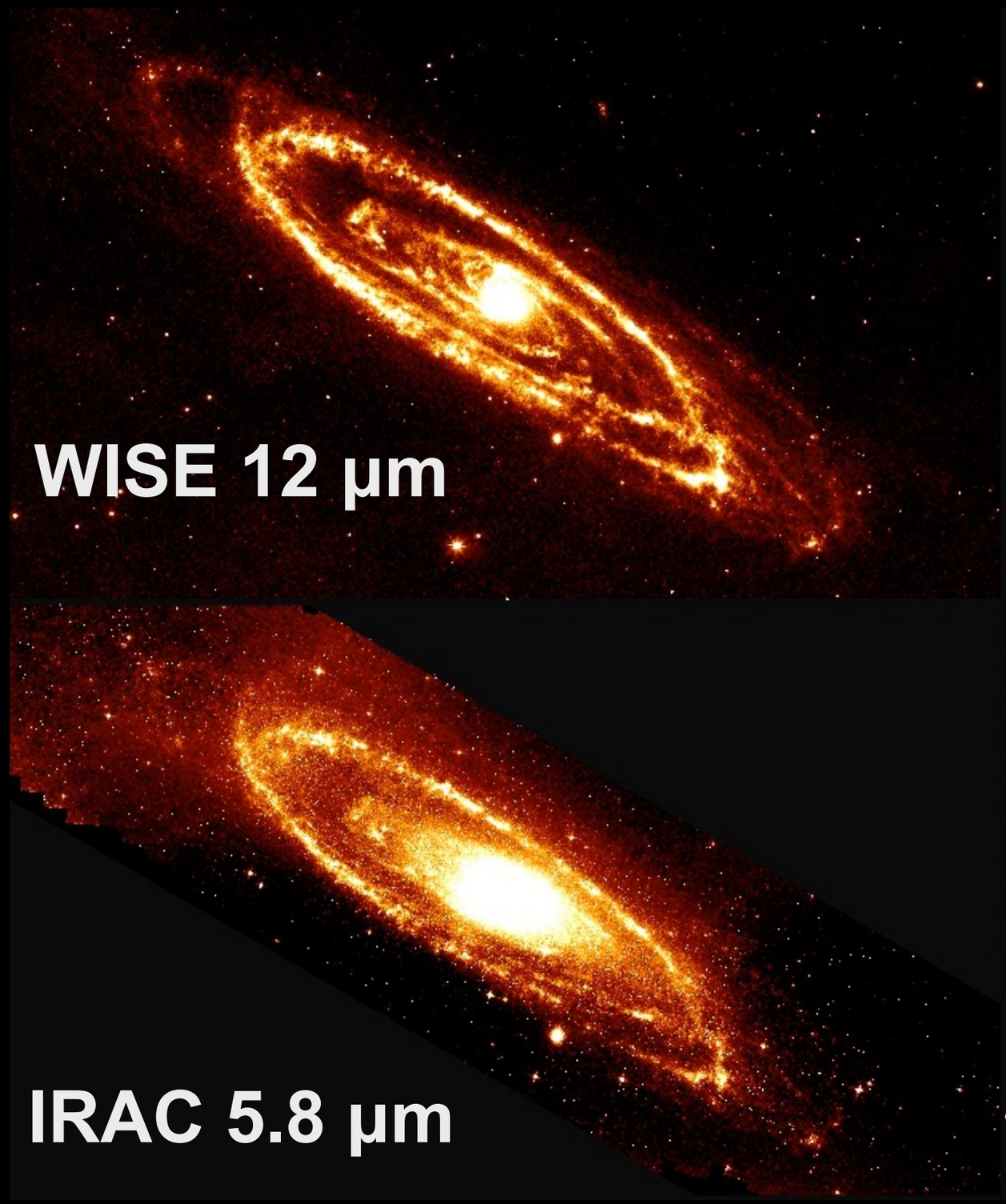
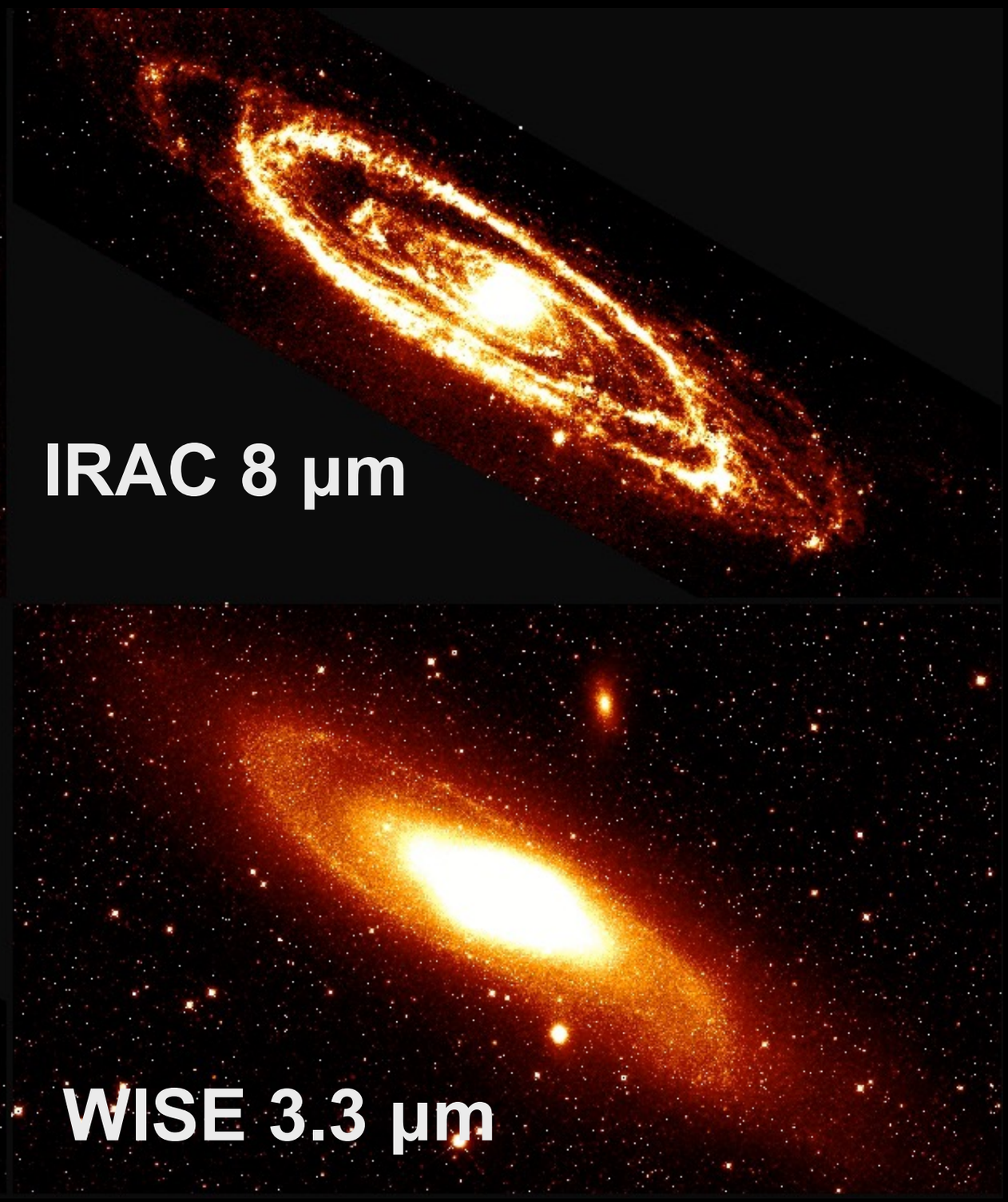


HELGA: MIR maps

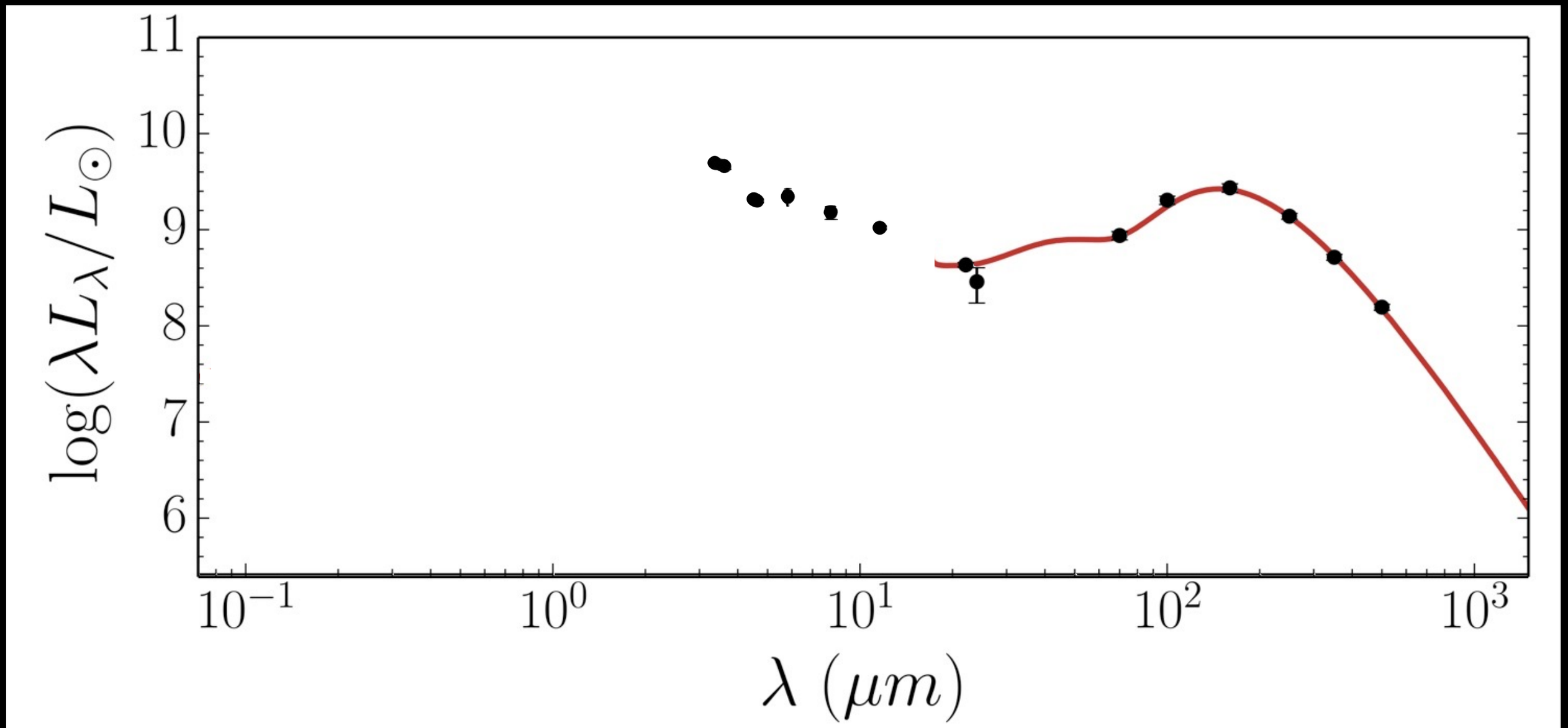




T. Jarret, P. Barmby

HELGA: MIR maps

- Hot dust / PAH + stellar emission



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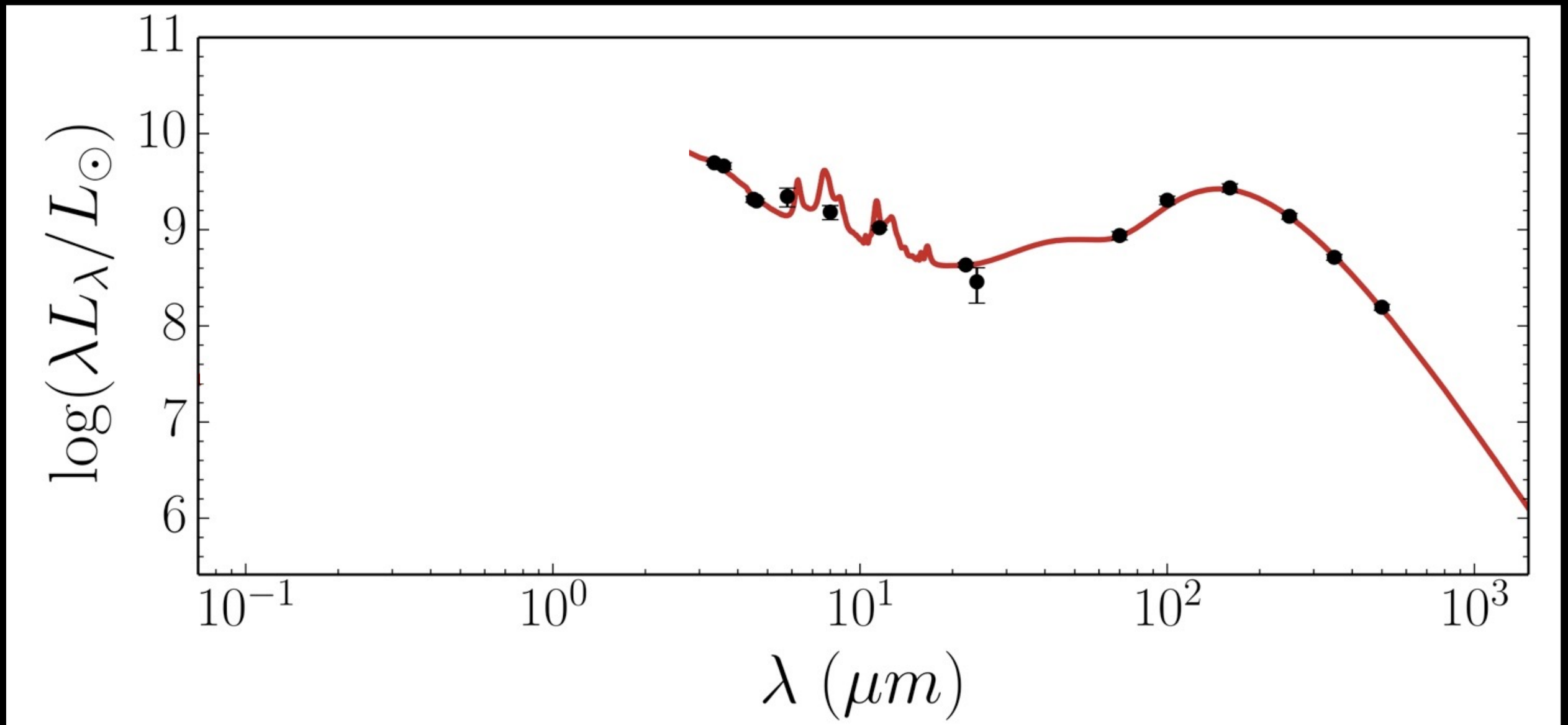

HELGA: Optical/UV

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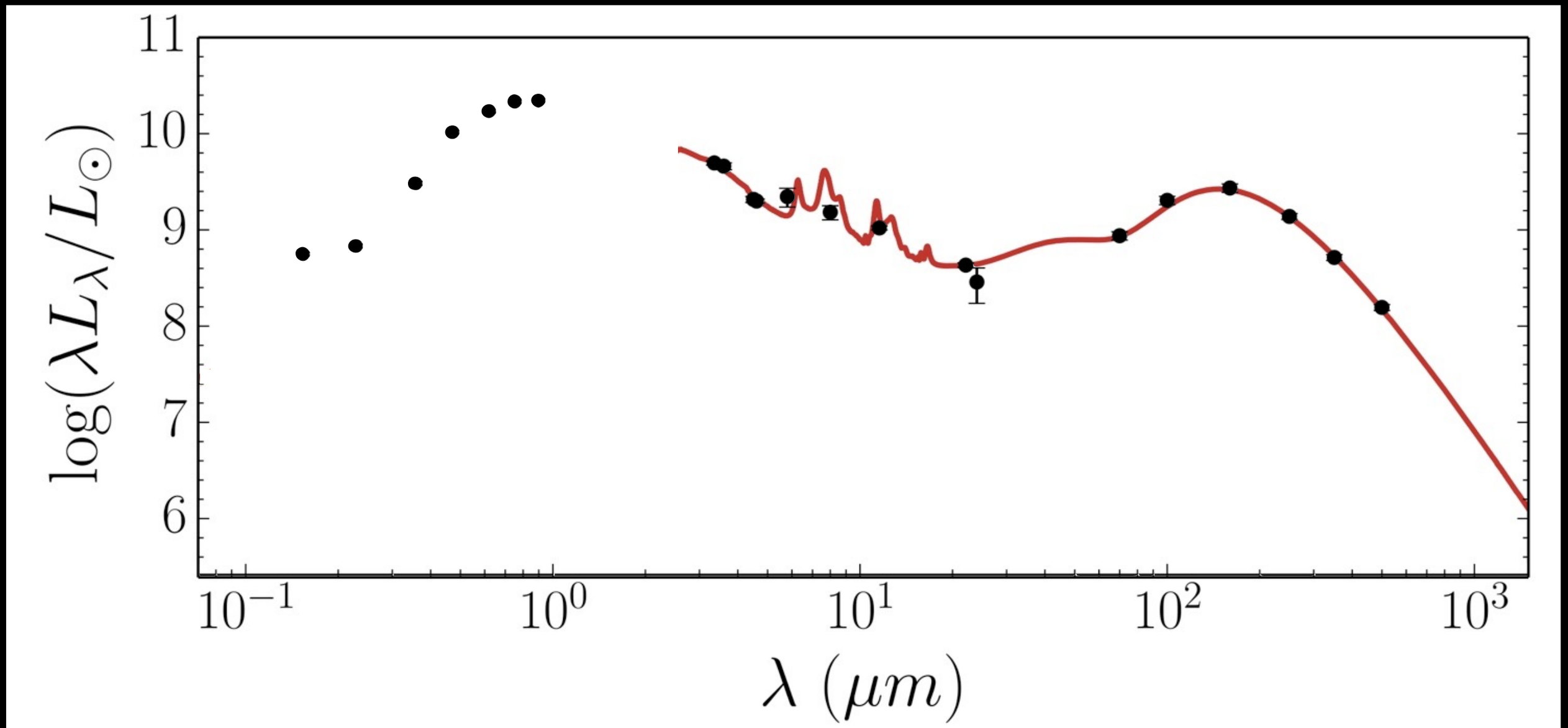
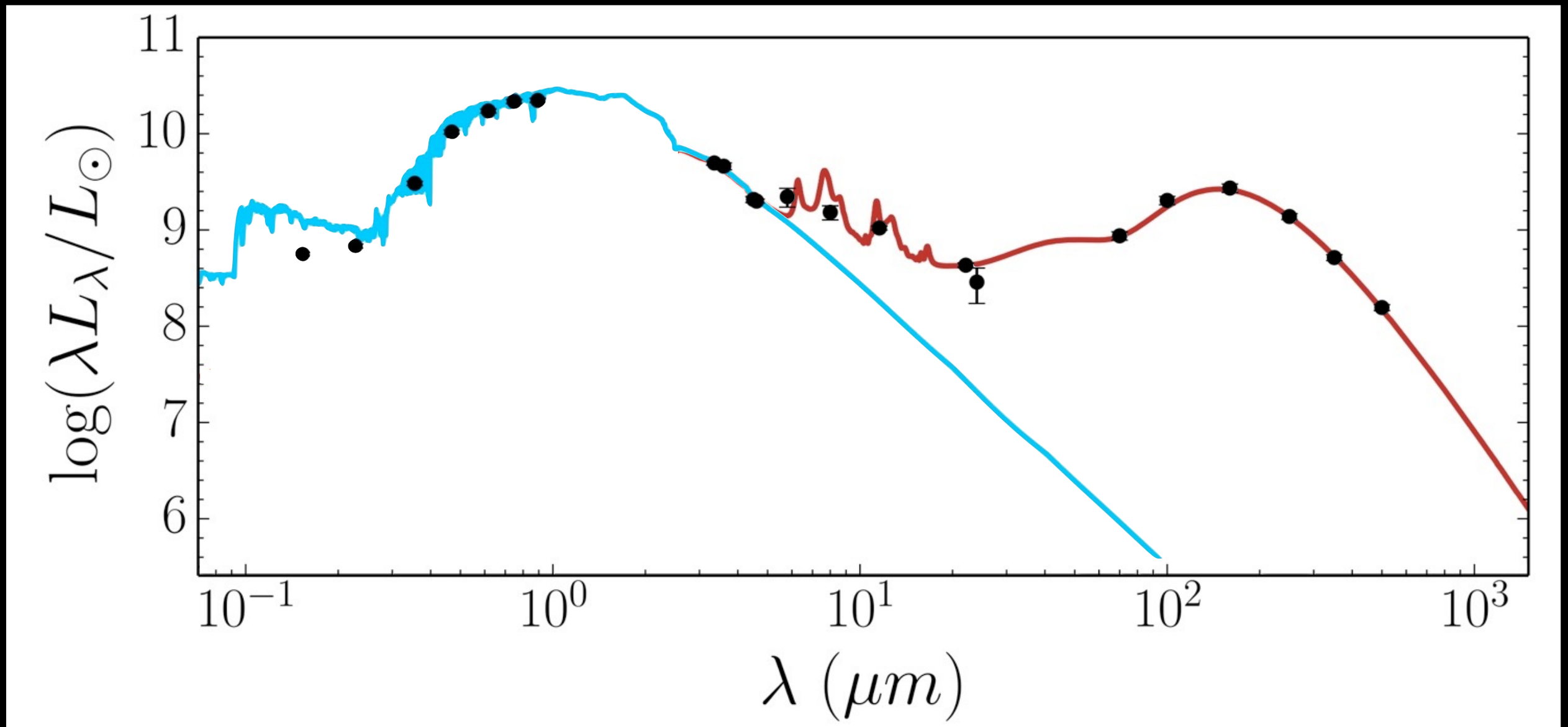
- Stellar emission



HELGA: Optical/UV

- Stellar emission (unattenuated)



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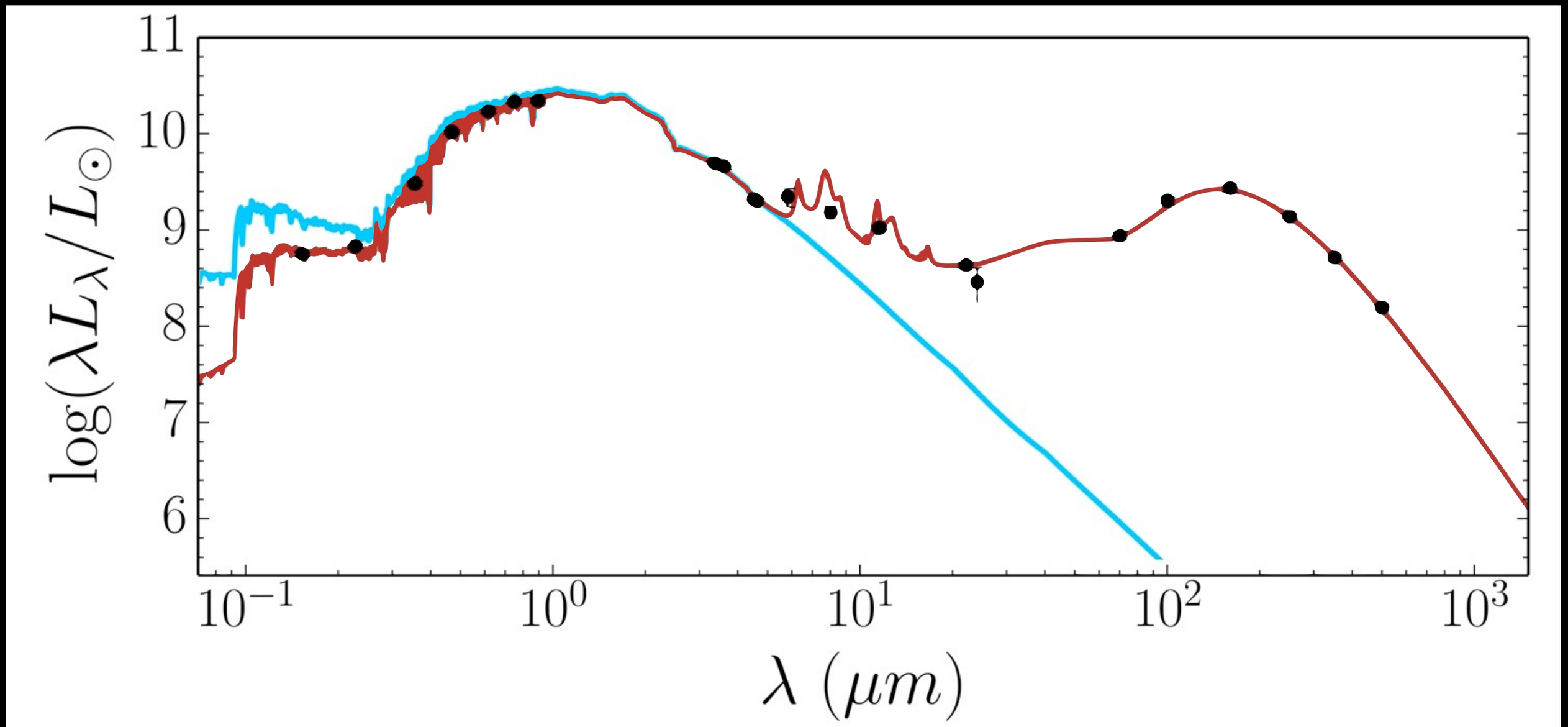


HELGA: Zooming in

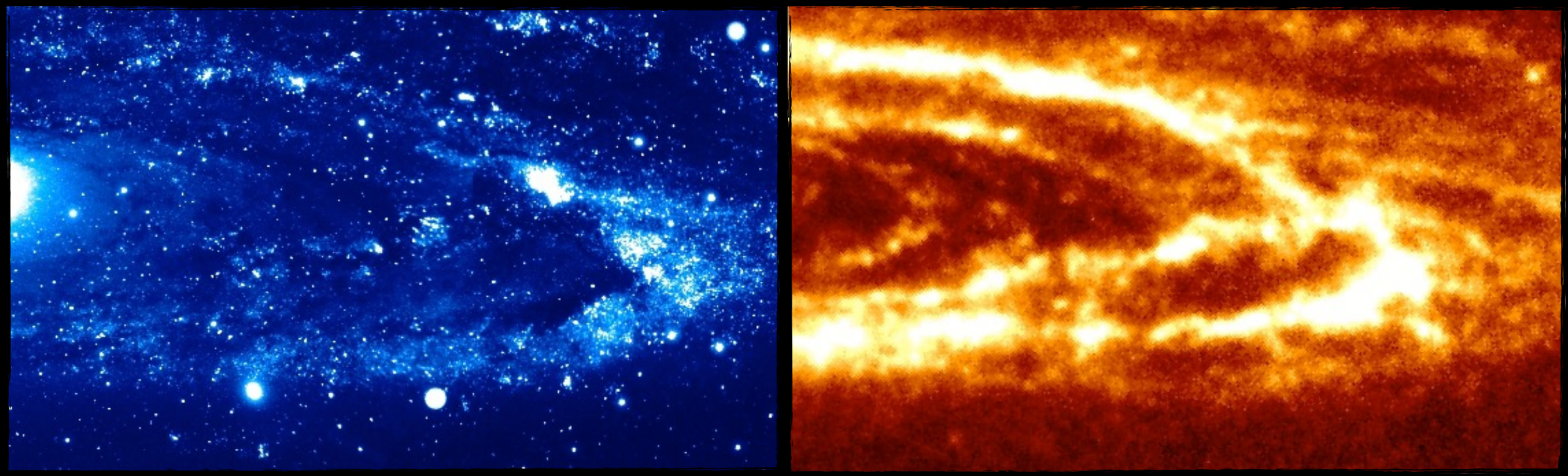
Pixel-by-pixel SED fitting

- Masking foreground stars
- Convolution to SPIRE 500 μm beam
- Same pixel grid

Working resolution:
36” -> 140 pc

Resulting Images

NUV **500 μm**



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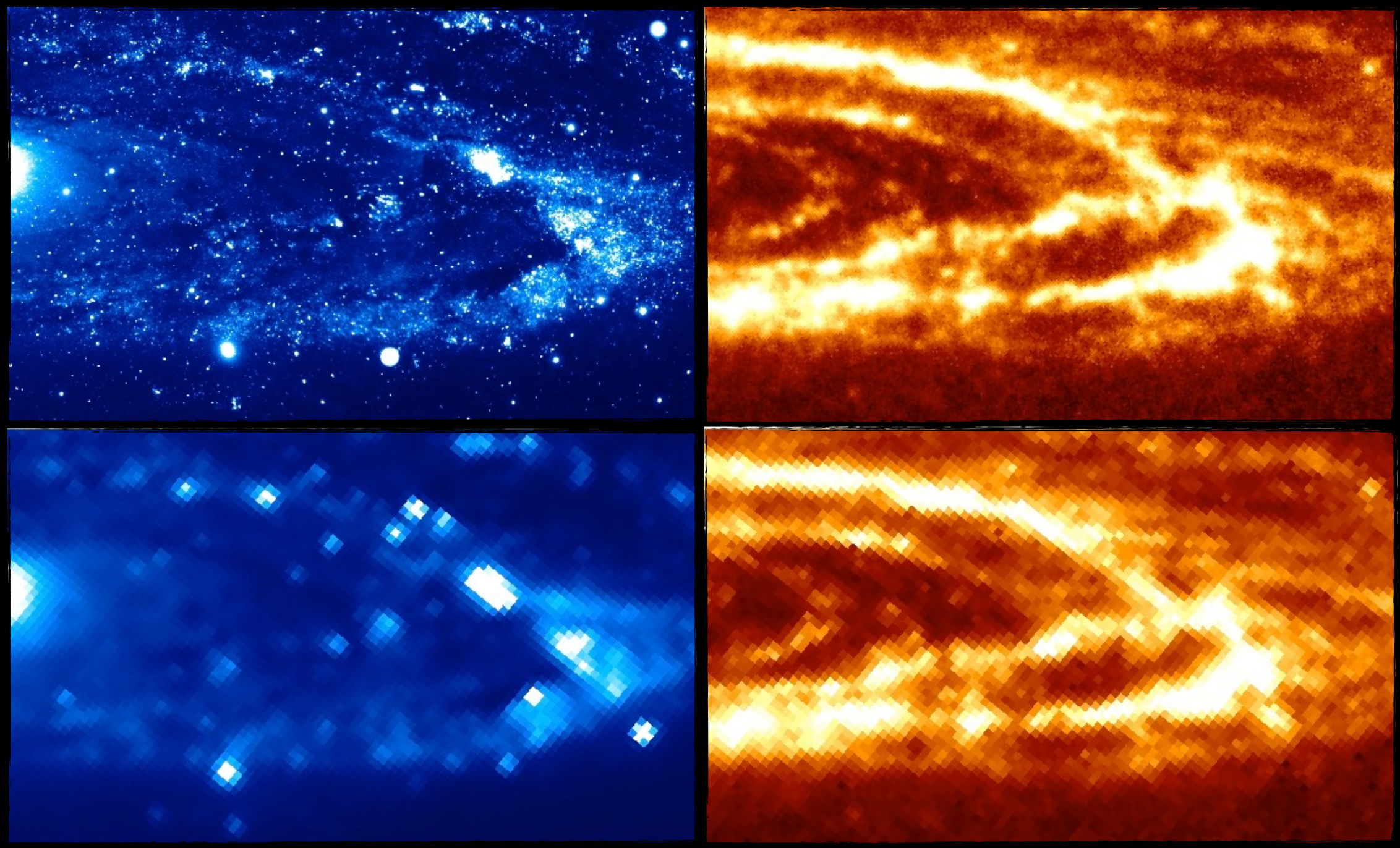

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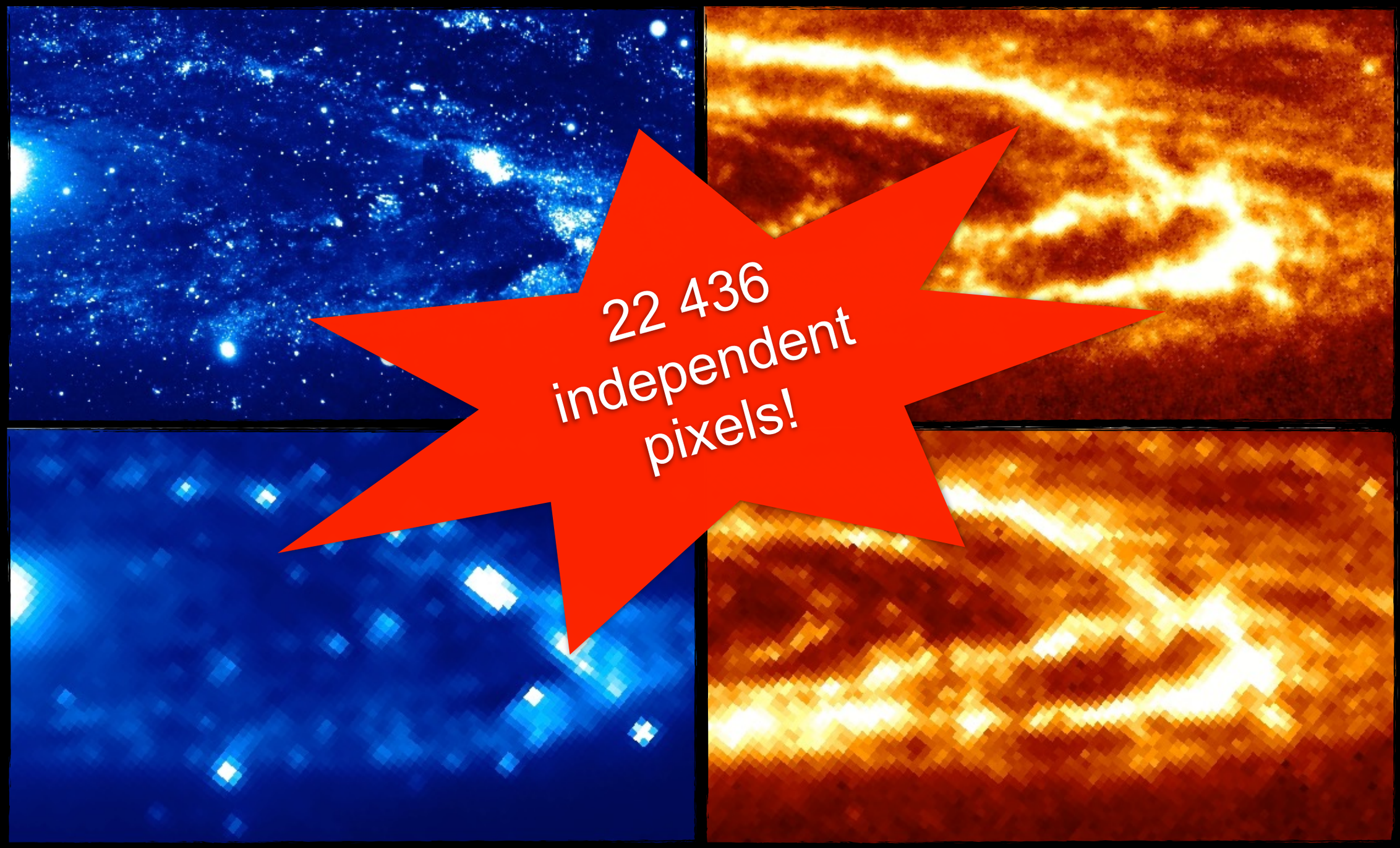
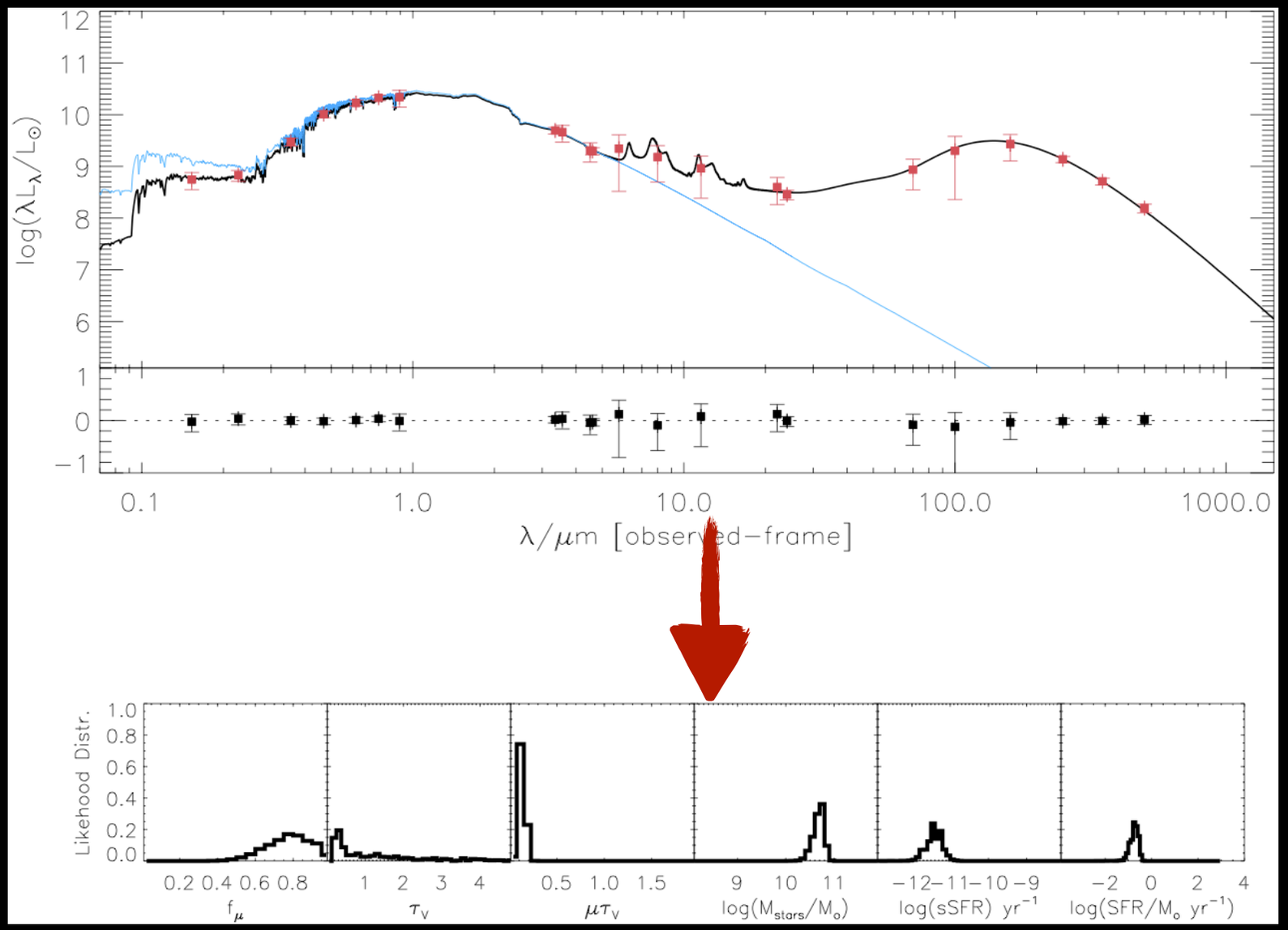


MAGPHYS: SED fitting

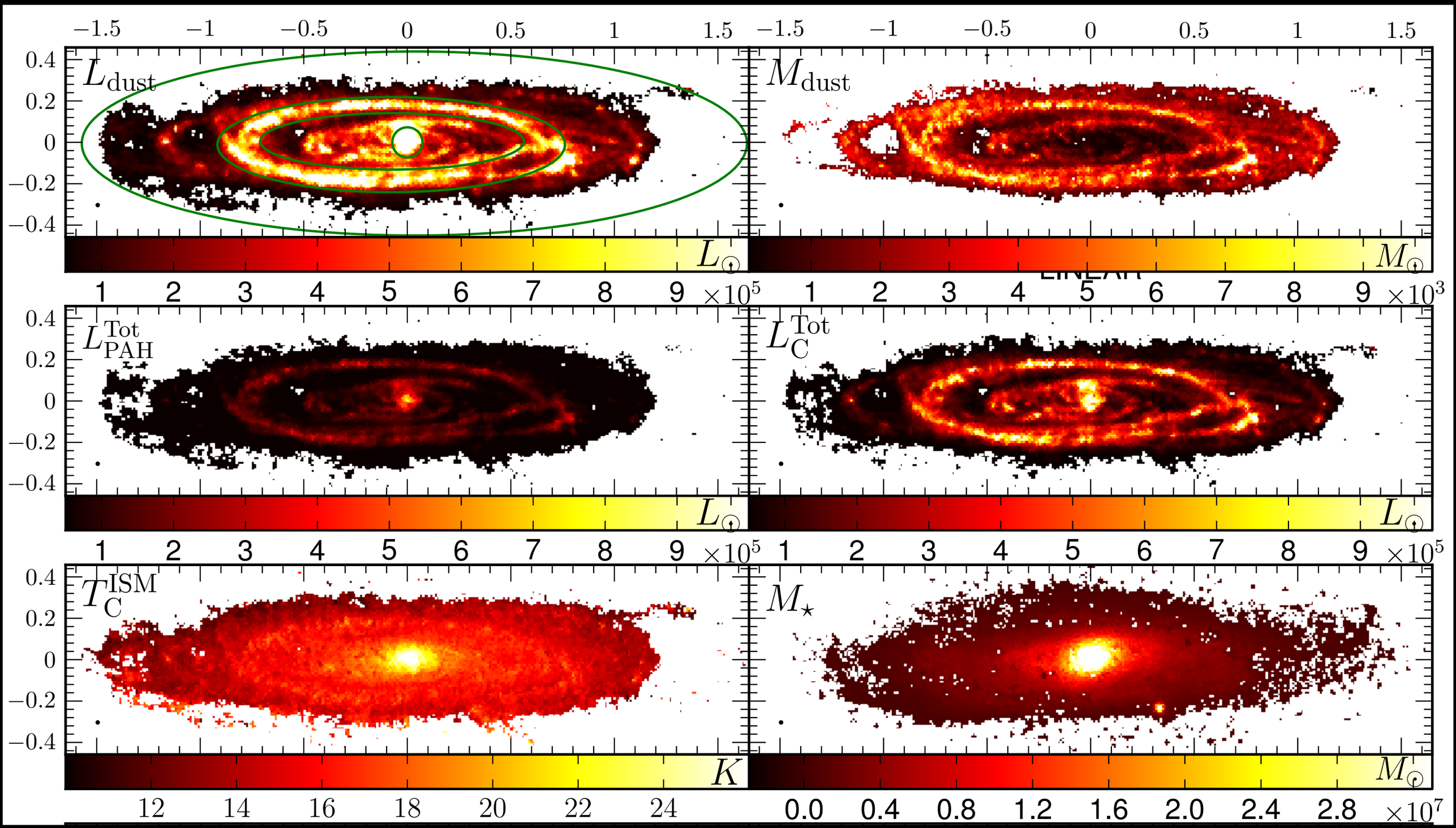
Multi-wavelength Analysis of Galaxy PHYSical properties

E. da Cunha et al. 2008

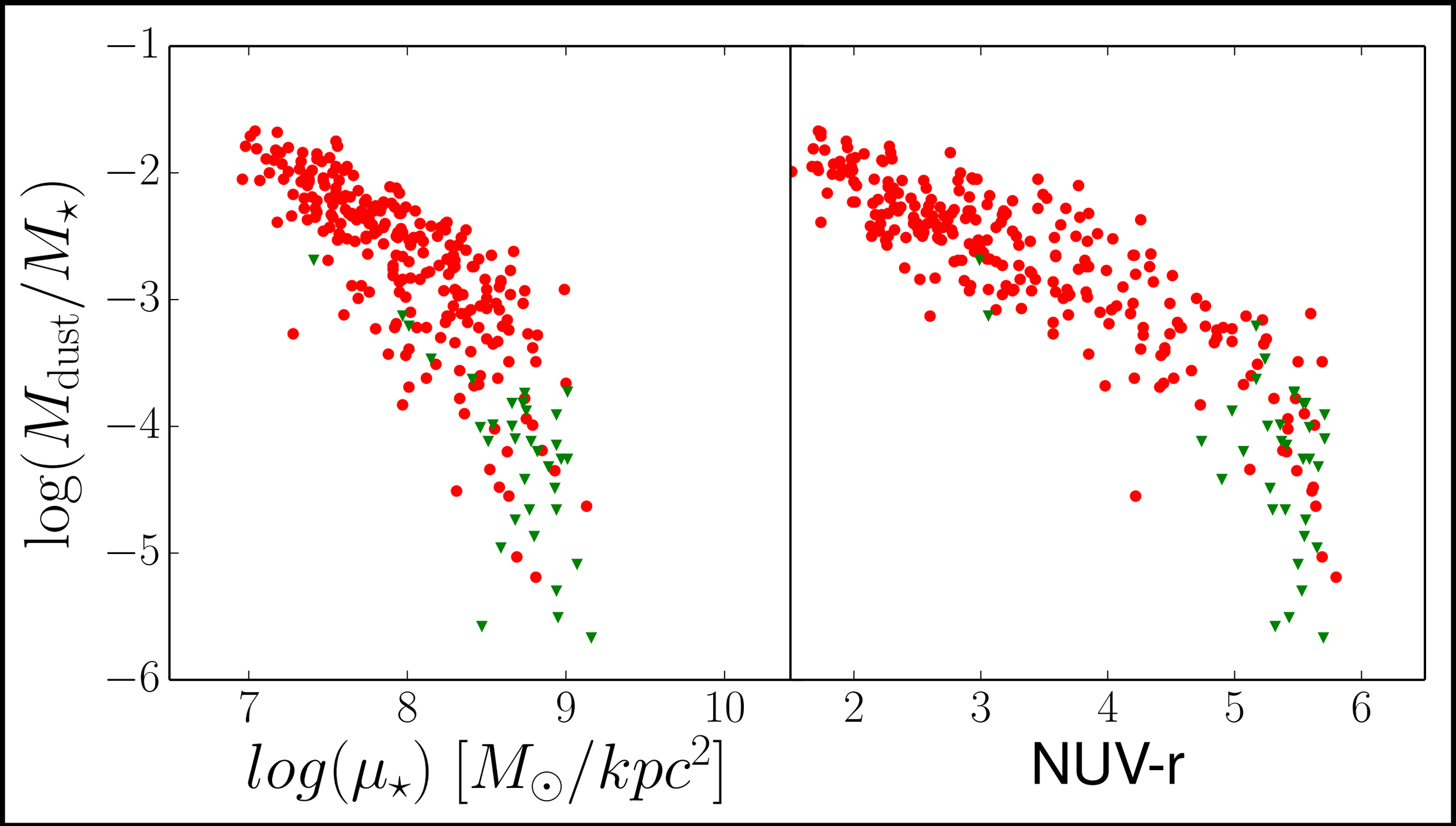
- Bayesian SED fits
- 75000 theoretical SEDs
- Construct Probability Density Functions (PDFs)



M31: Parameter maps



HRS: Dust scaling relations



Cortese et al. 2012

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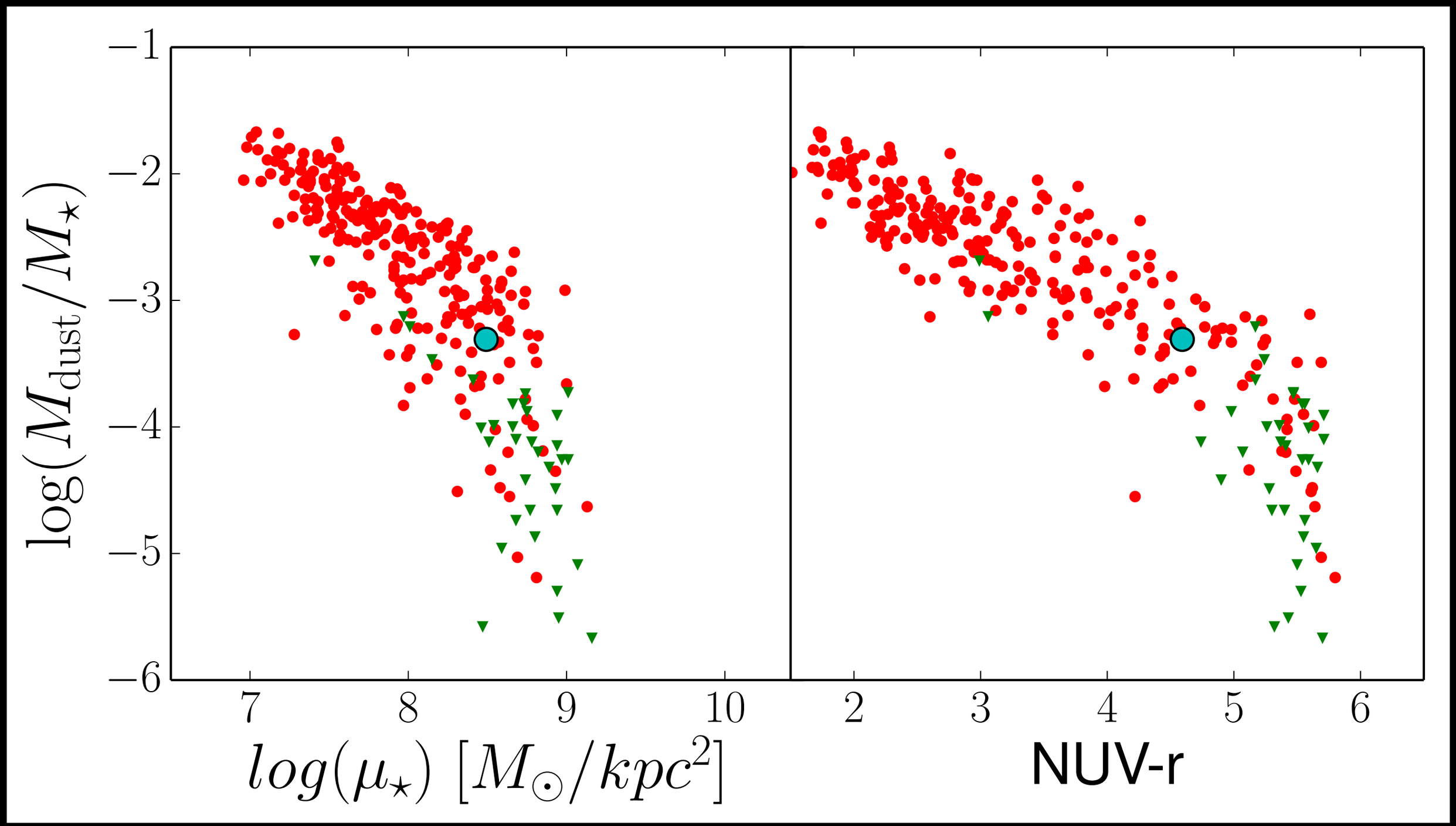

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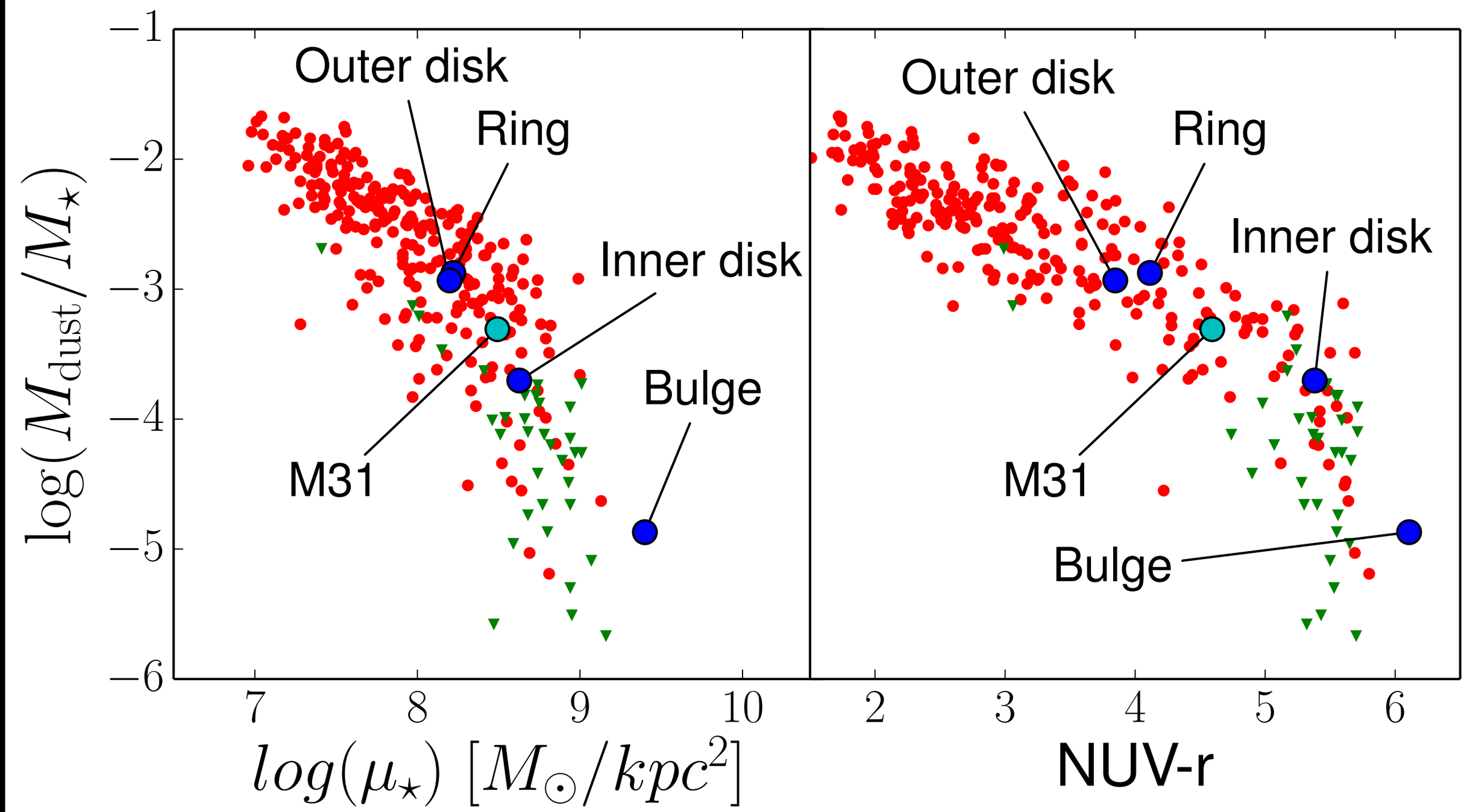

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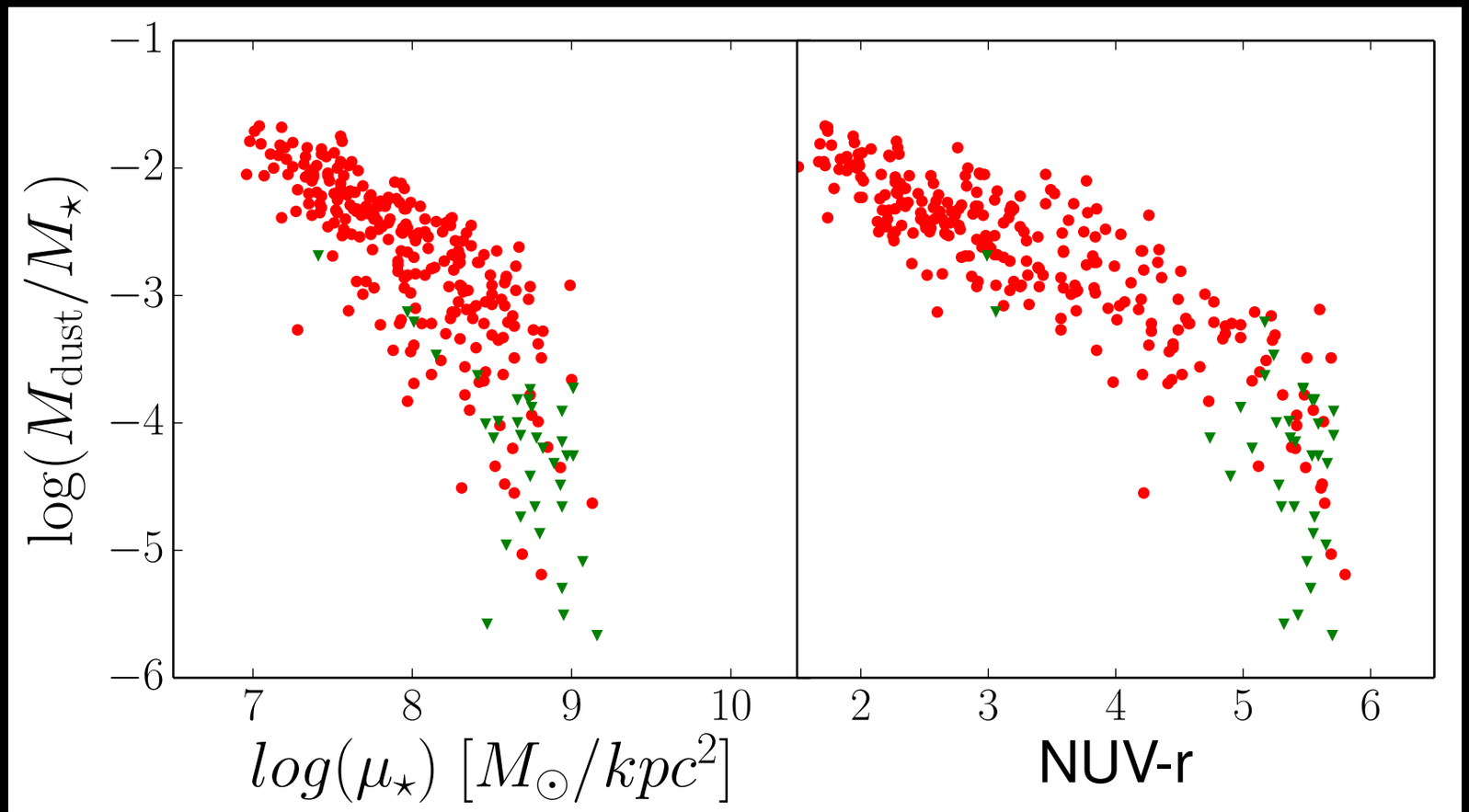

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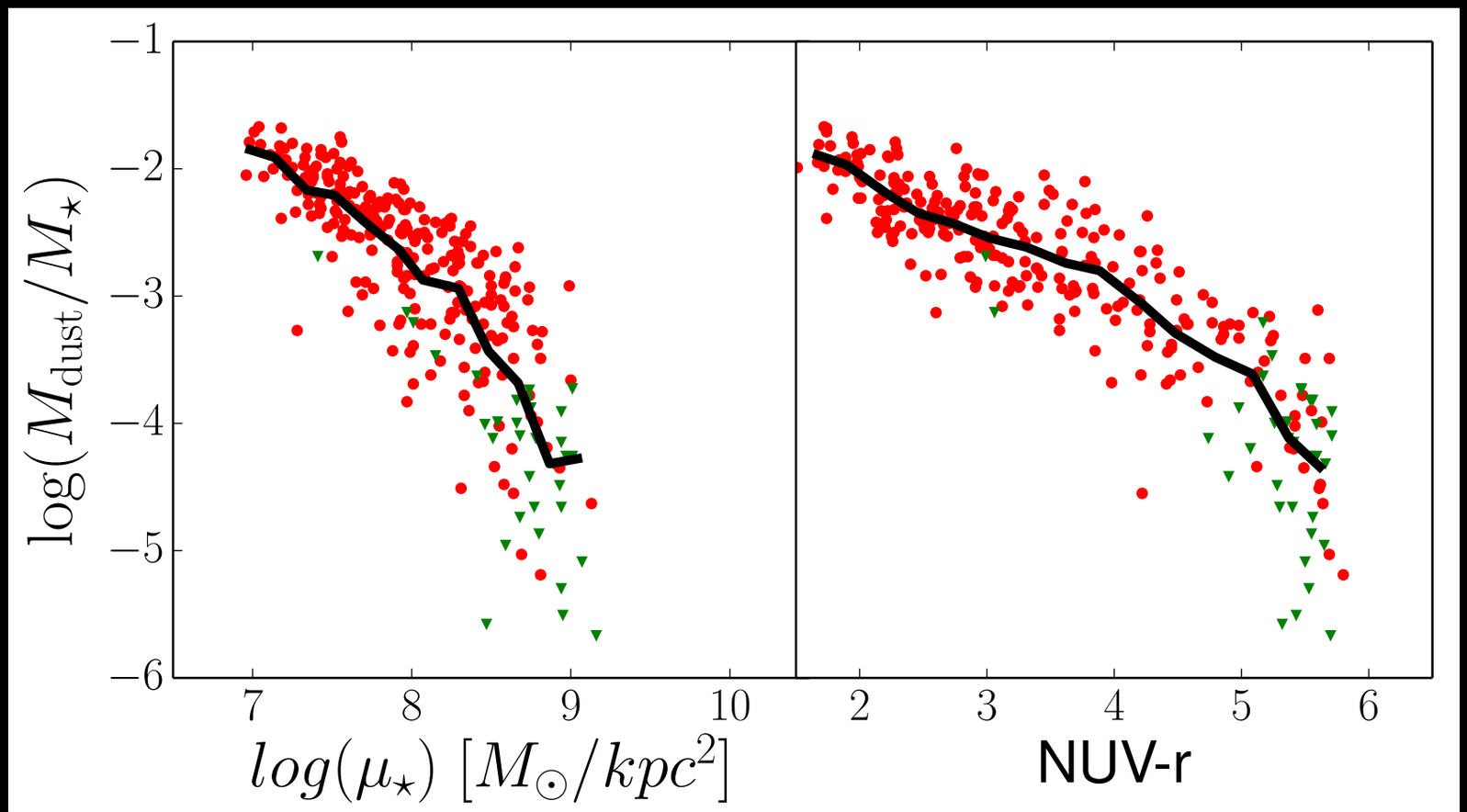

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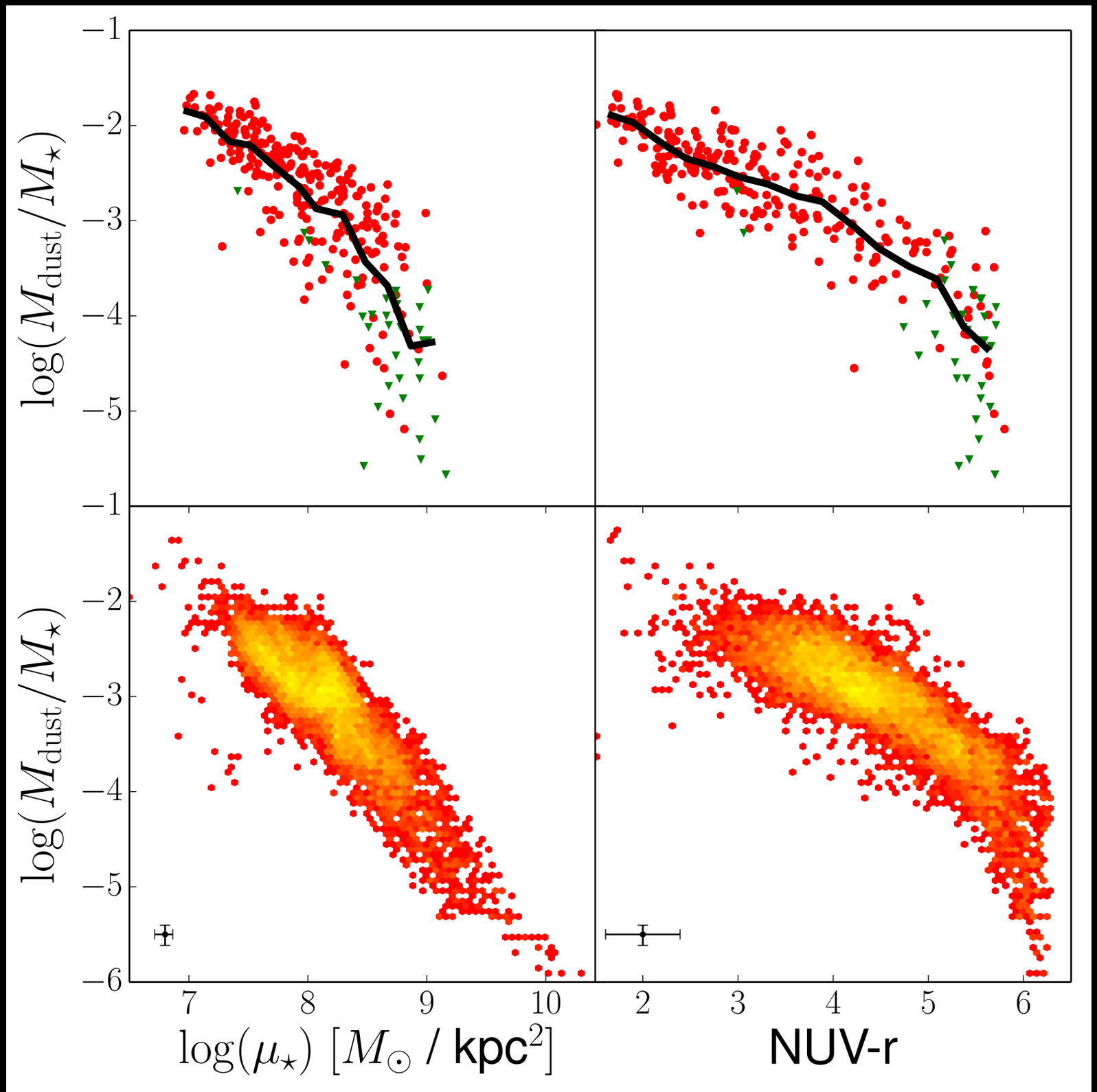

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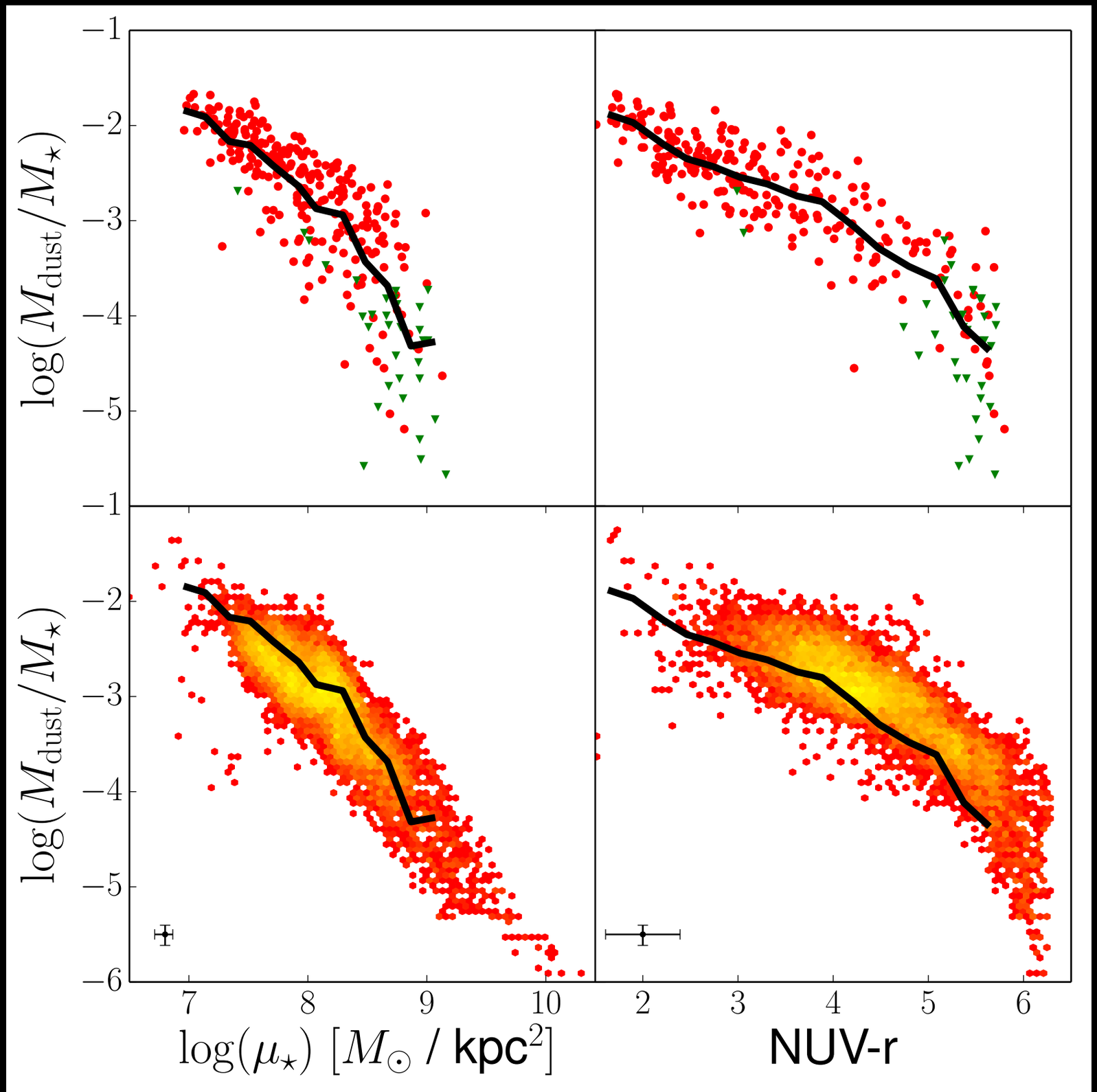
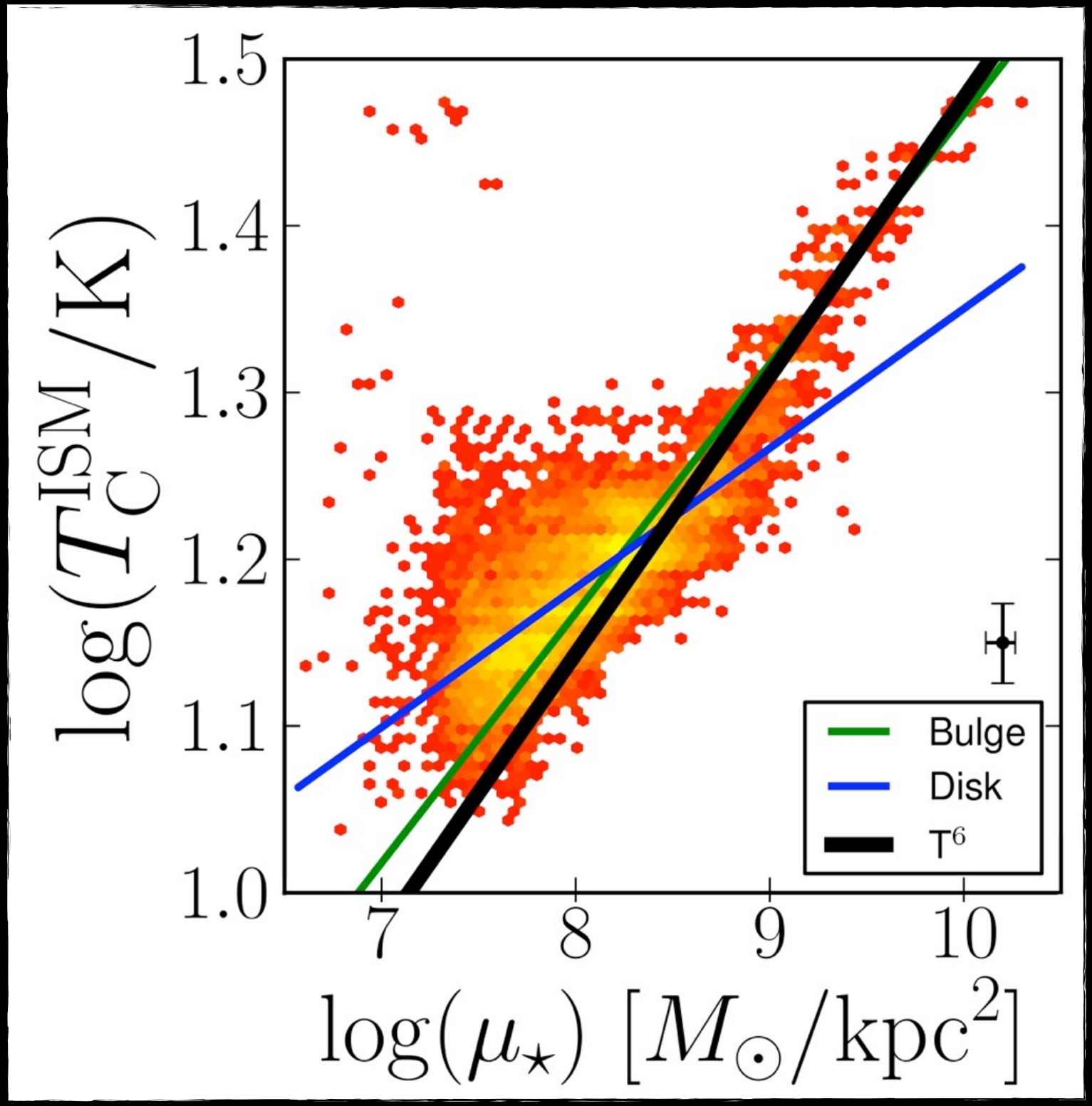


M31: Dust heating sources



M31: Dust Scaling Relations

In Summary

- Panchromatic, sub-kpc SED modelling is now possible, BUT requires:
  - Special data treatment (masking, convolution,...)
  - Extended parameter space
- Resolved maps - 140 pc - of stellar and dust properties
- Sub-kpc regions follow galaxy-galaxy dust scaling relations; local nature of the underlying processes

Viaene et al. A&A, 567, A71

Future work: A 3D model

- Use these results as input for radiative transfer simulations
- SKIRT, a 3D Monte Carlo code for dust radiative transfer
  - 3D implementation of stellar and dust geometries
  - Self-consistent treatment of dust-starlight interactions
- Recipe successfully applied to M51 (De Looze et al. 2014)

http://www.skirt.ugent.be