JOYS:
JWST Observations of Young protoStars

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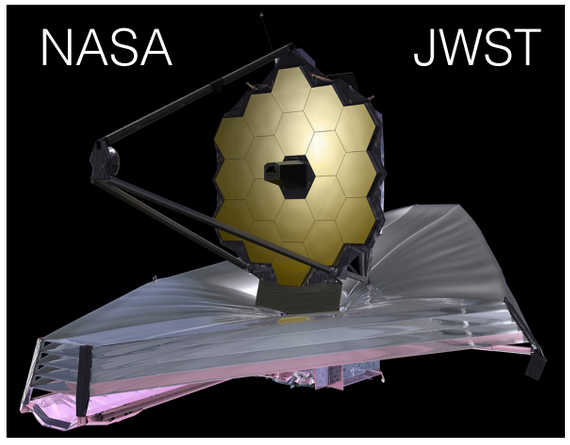
G. Perotti, M.L. van Gelder, P. Klaassen, A. Caratti o Garatti
L. Francis, W.R.M. Rocha, K. Slavicinska, T. Ray, K. Justanont,
H. Linnartz & the MIRI GTO team

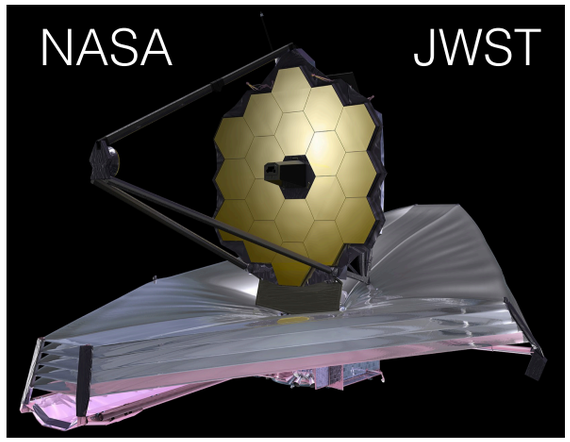
EPOS, Ringberg , May 15, 2024

JOYS & region overview



- ~24 low- to high-mass regions
- Full MIRI IFU coverage from 5 to 28μm
- Goals: Dissect the physical and chemical properties of you protostars of all masses
- —> Case study of first observed high-mass source

JOYS & region overview



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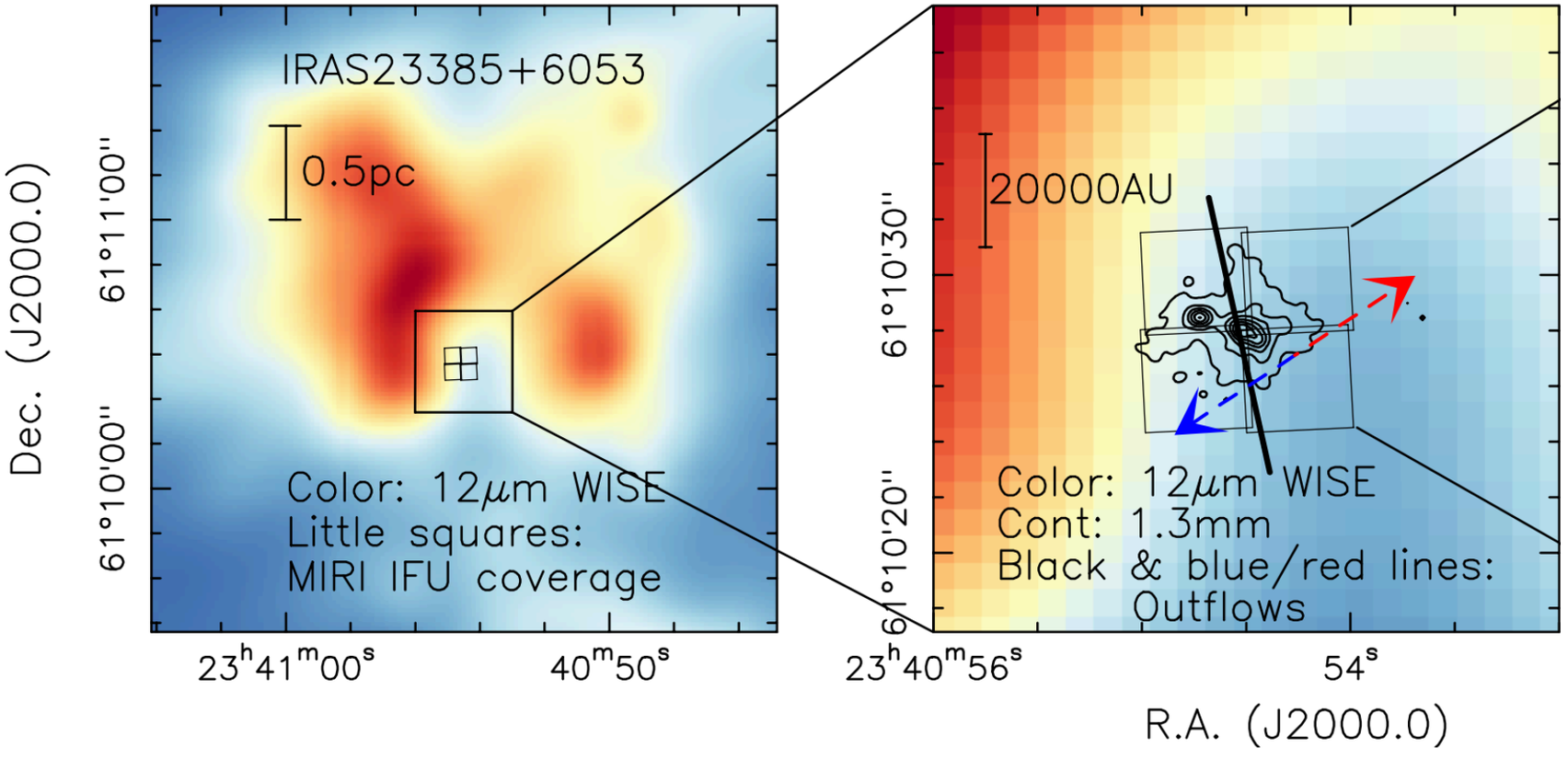
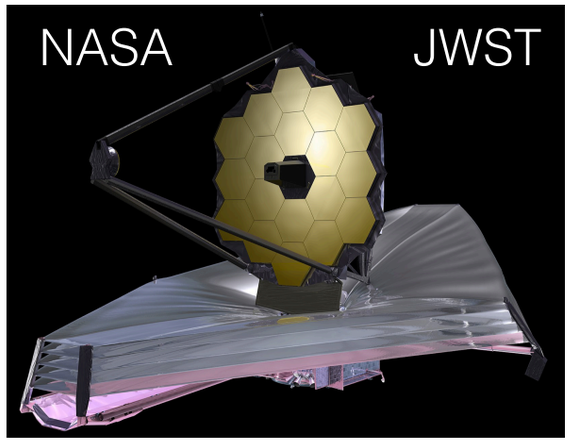


Beuther et al. 2023, van Dishoeck et al. 2023

JOYS & region overview



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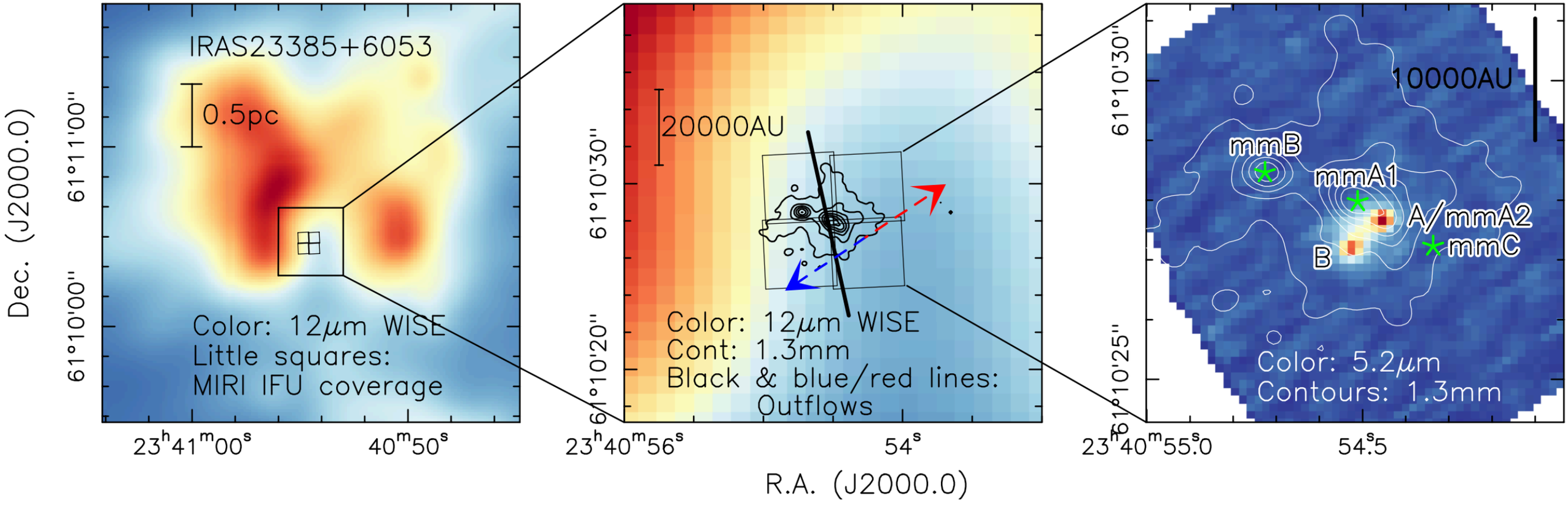

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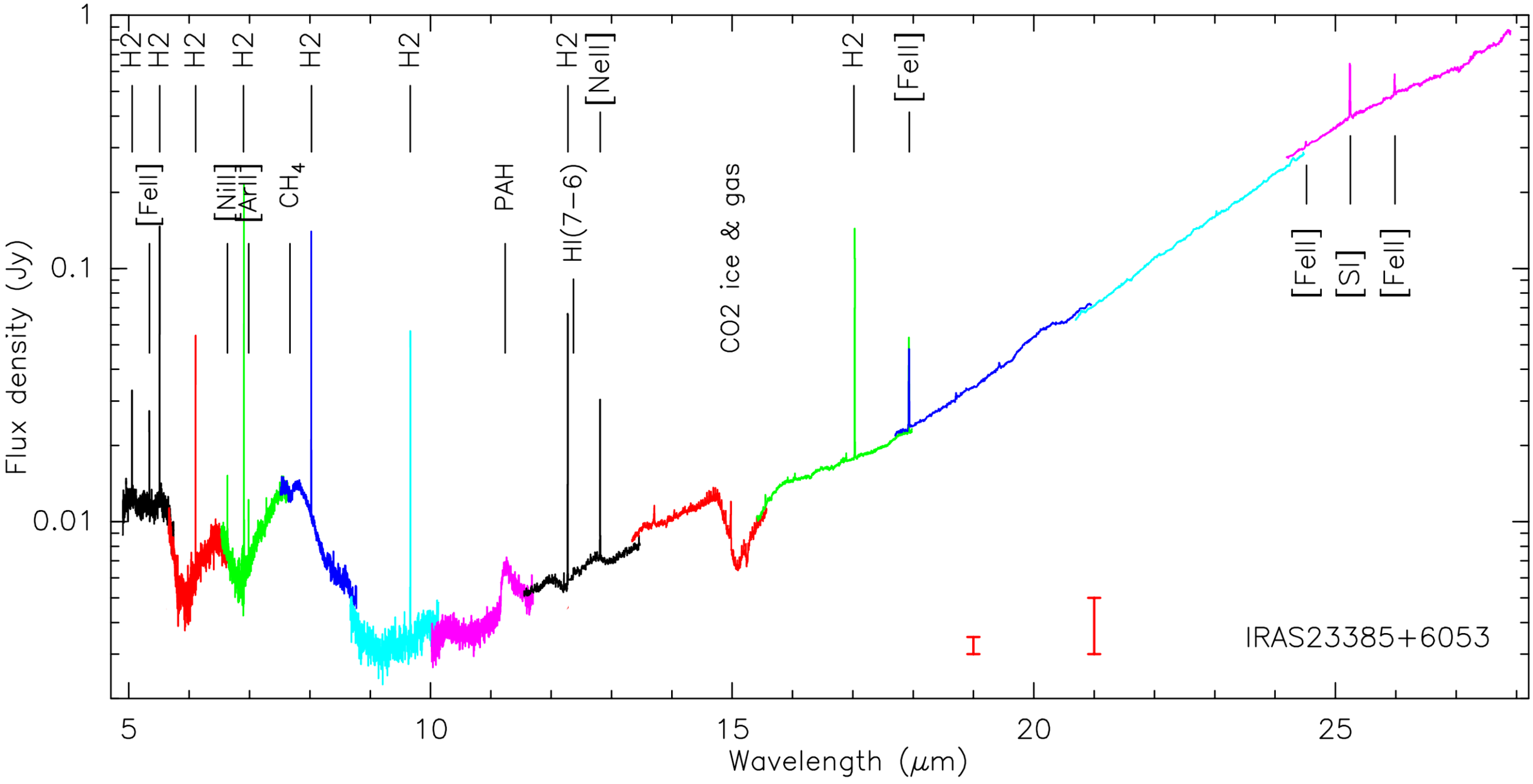
Overall MIRI spectrum



Beuther et al. 2023

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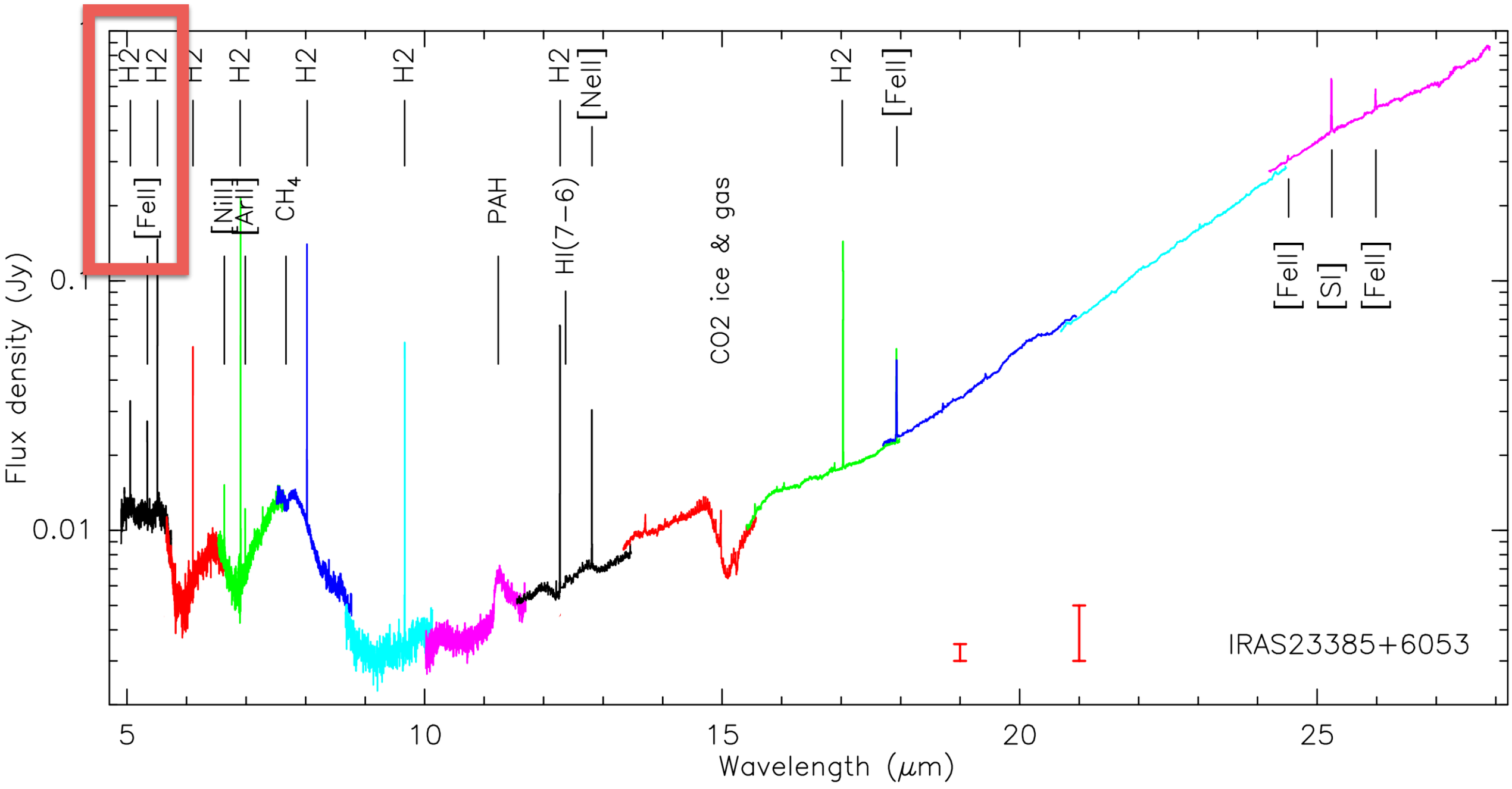

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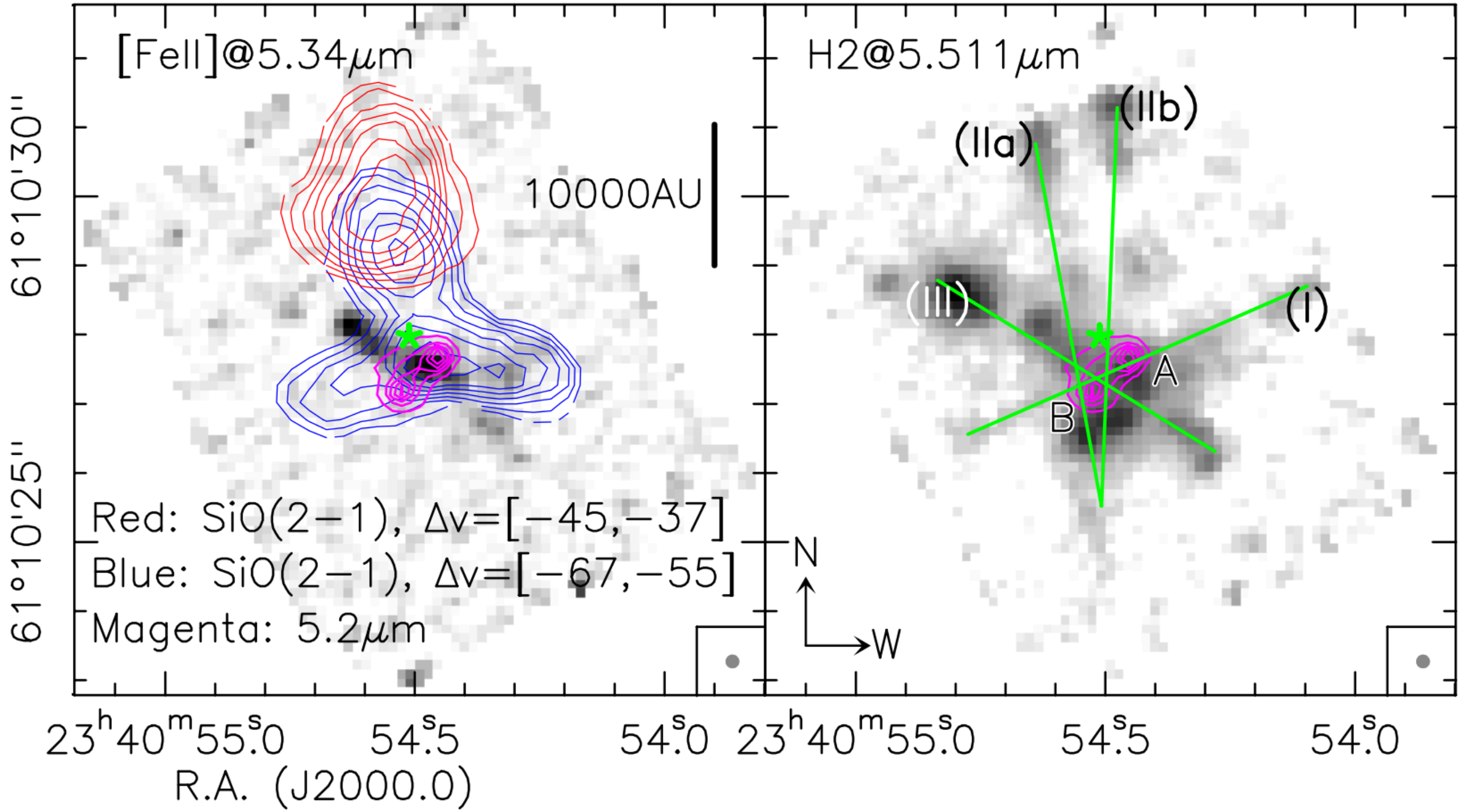
Outflows



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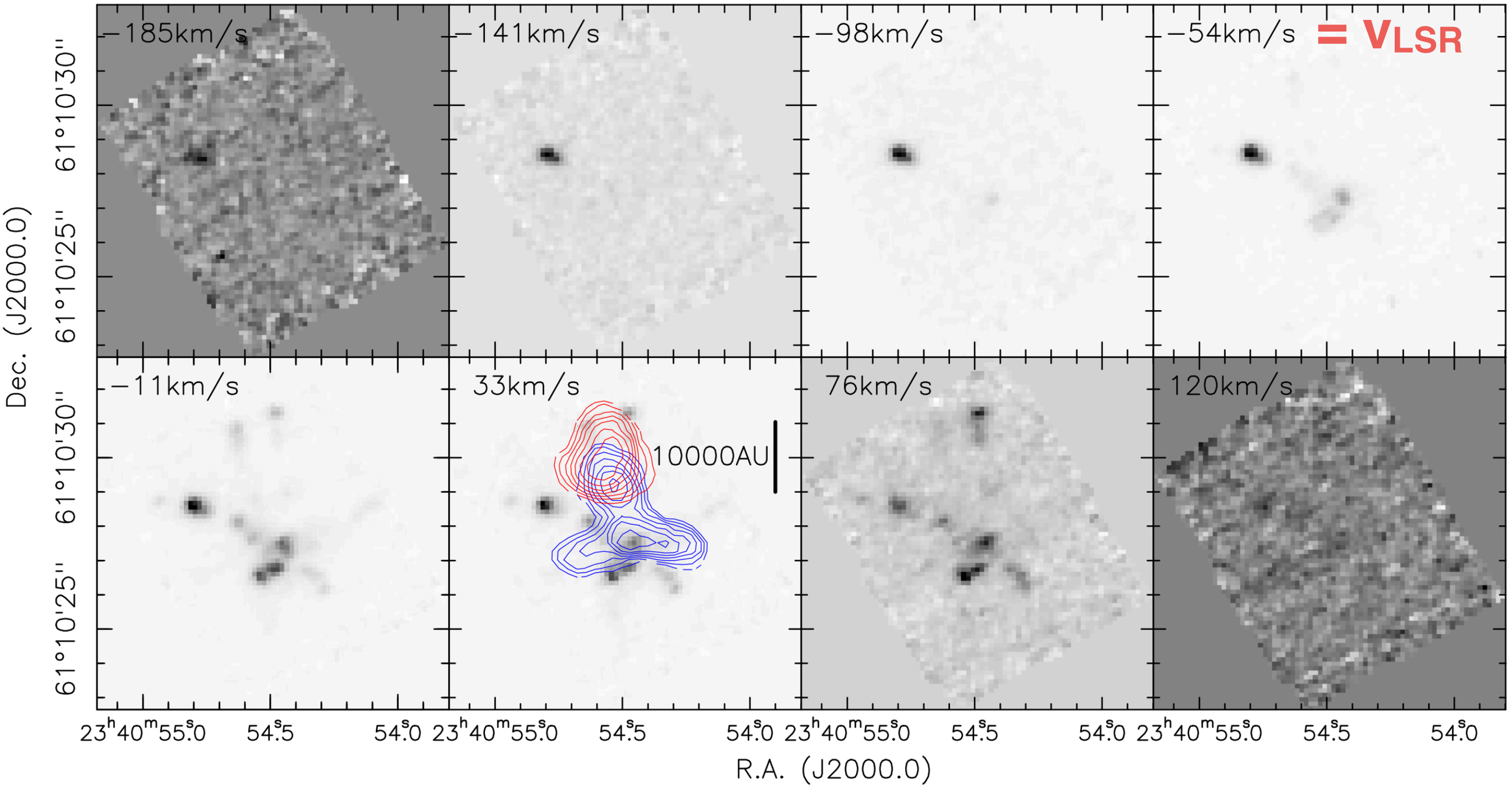
H2@5.511μm channel map



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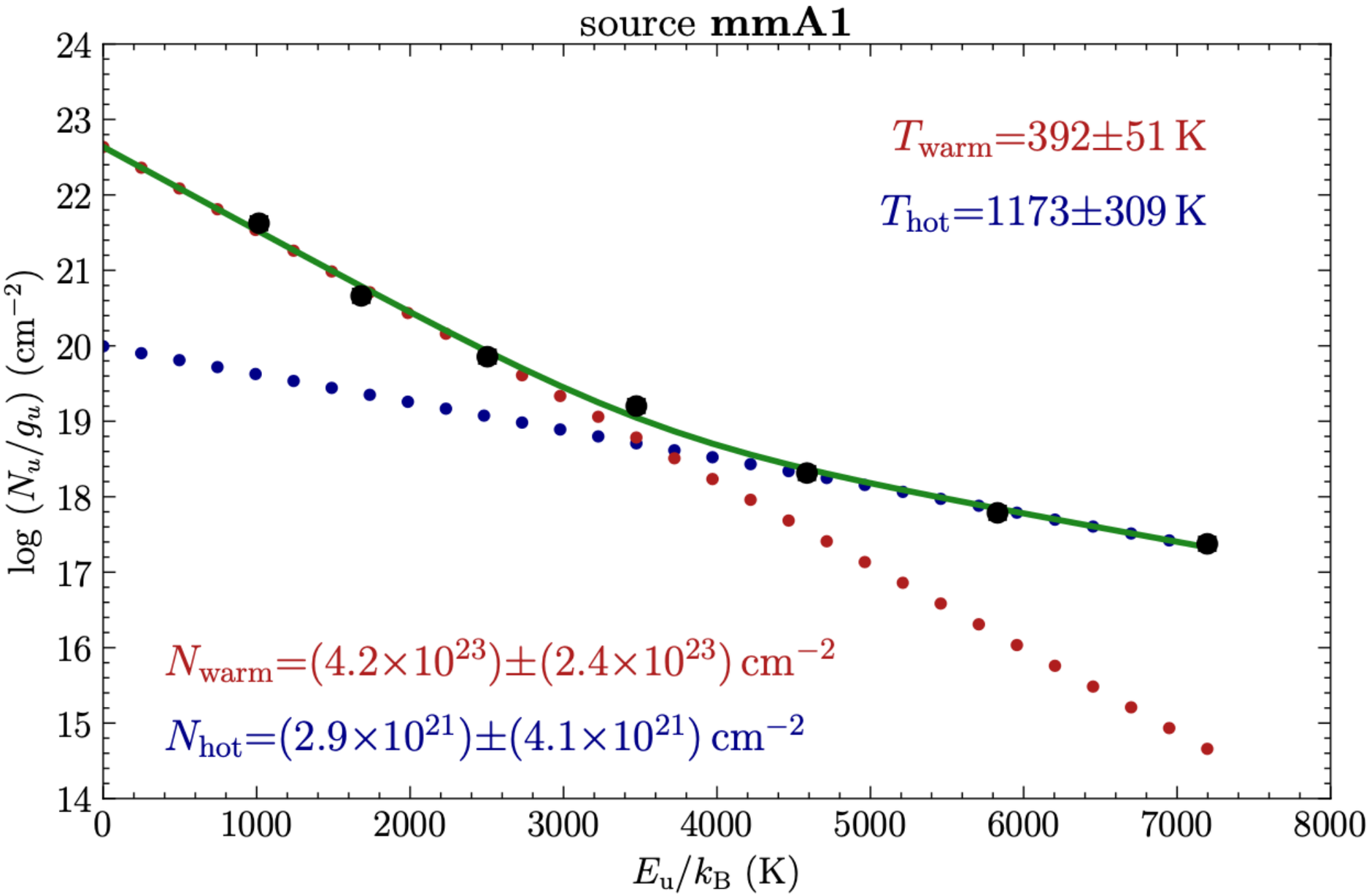
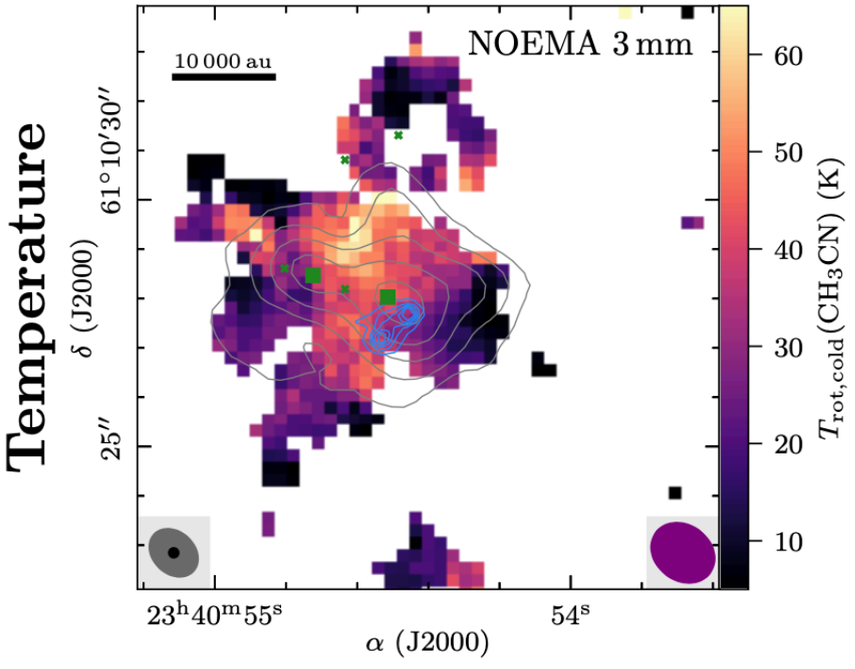
Temperature structure



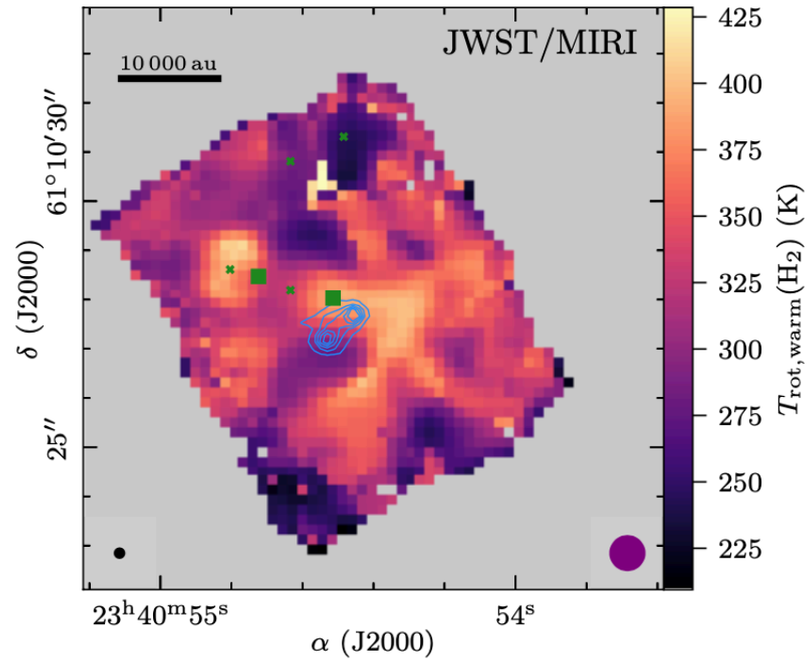
H2 rotational diagram

Gieser et al. 2023

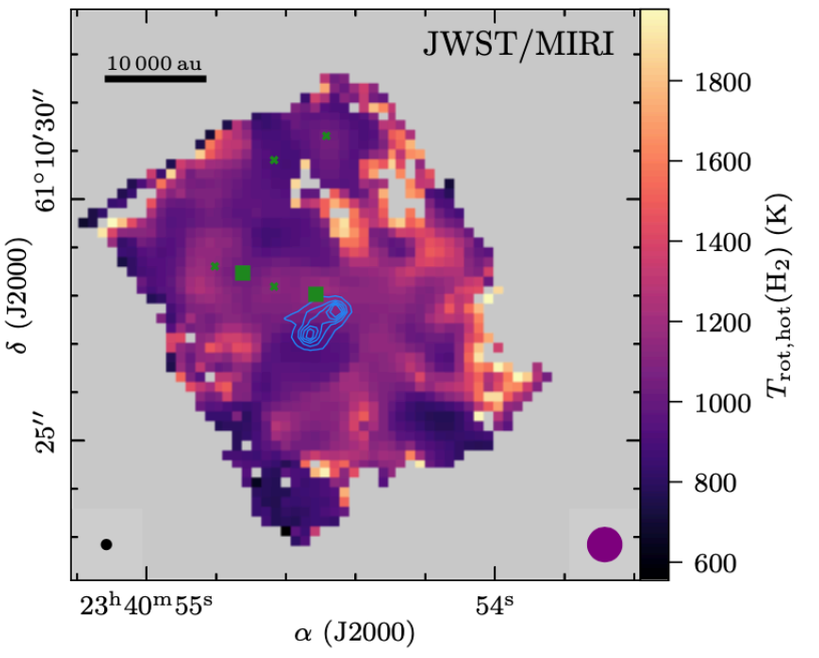
Temperature structure



CH3CN cold



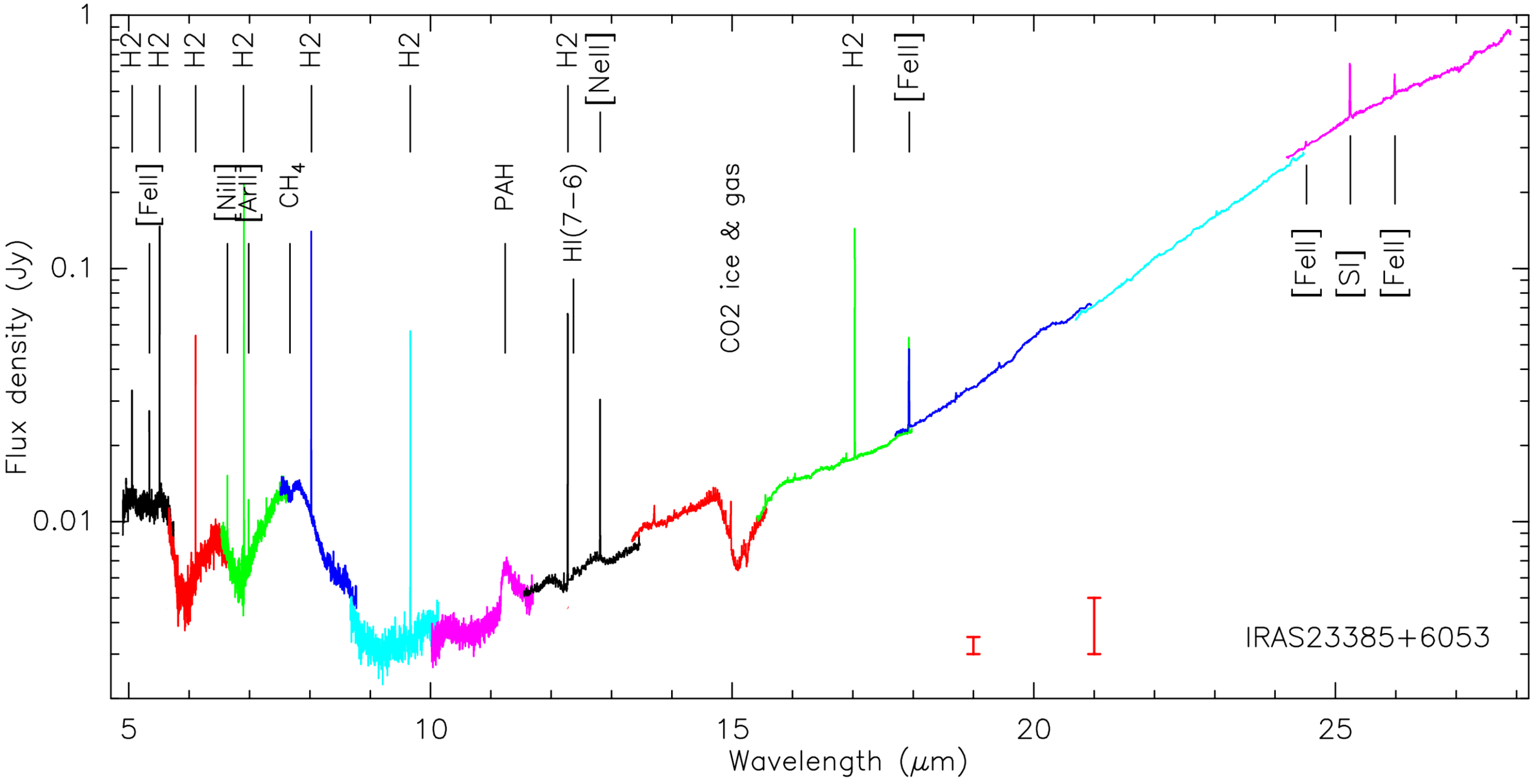
H2 warm



H2 hot

Gieser et al. 2023

Humphreys alpha as accretion tracer?



Beuther et al. 2023

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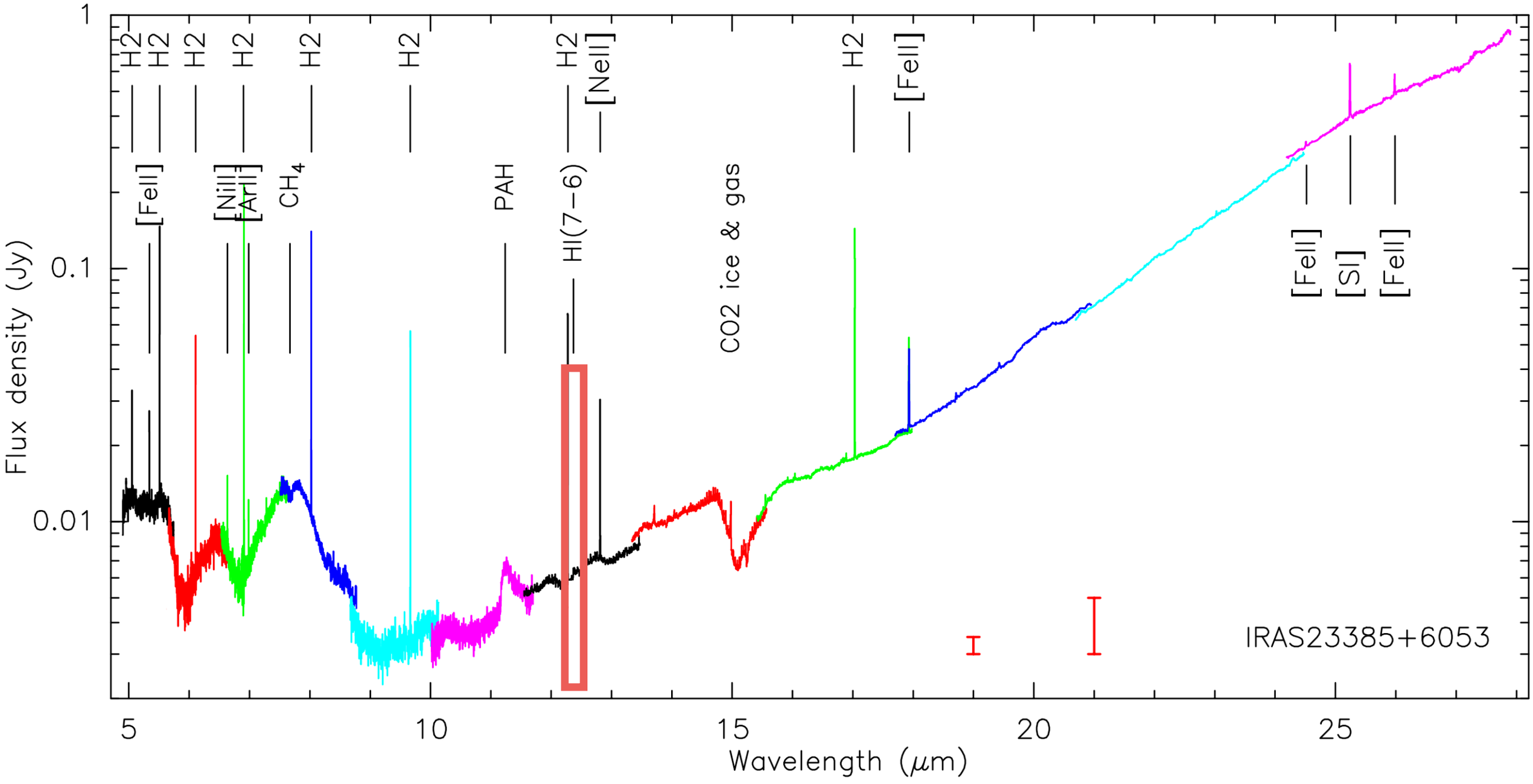

Beuther et al. 2023

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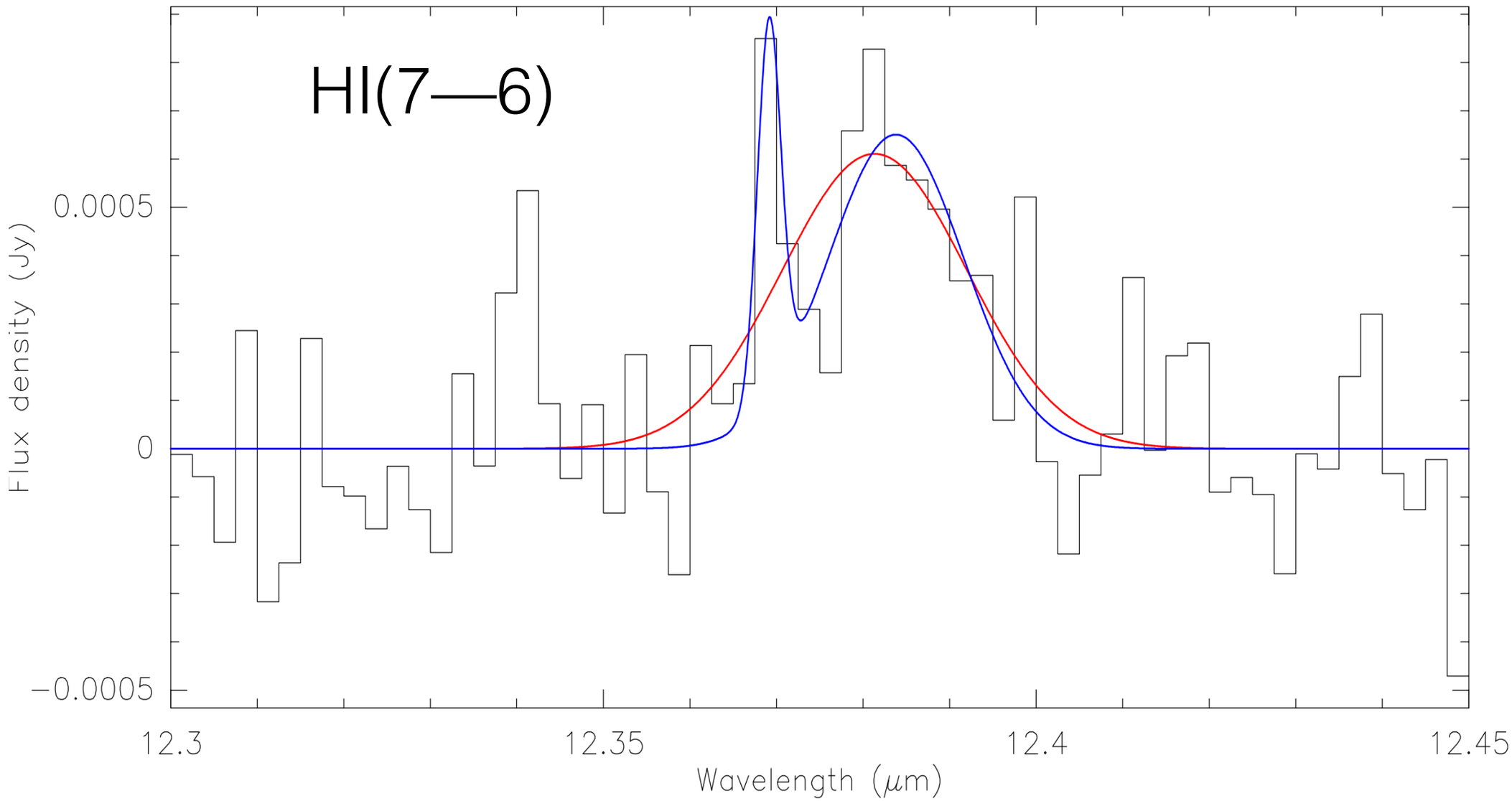

Beuther et al. 2023

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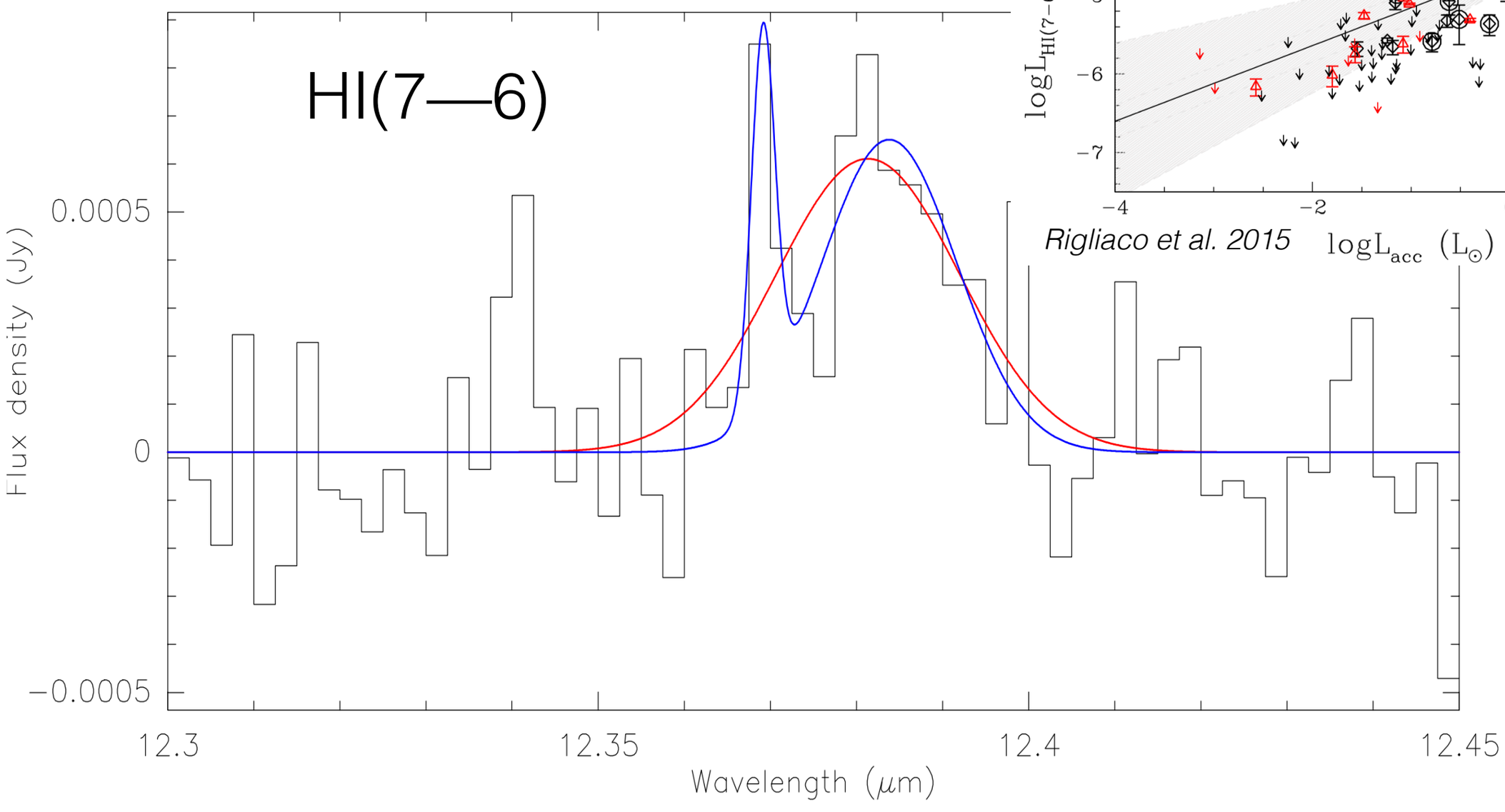

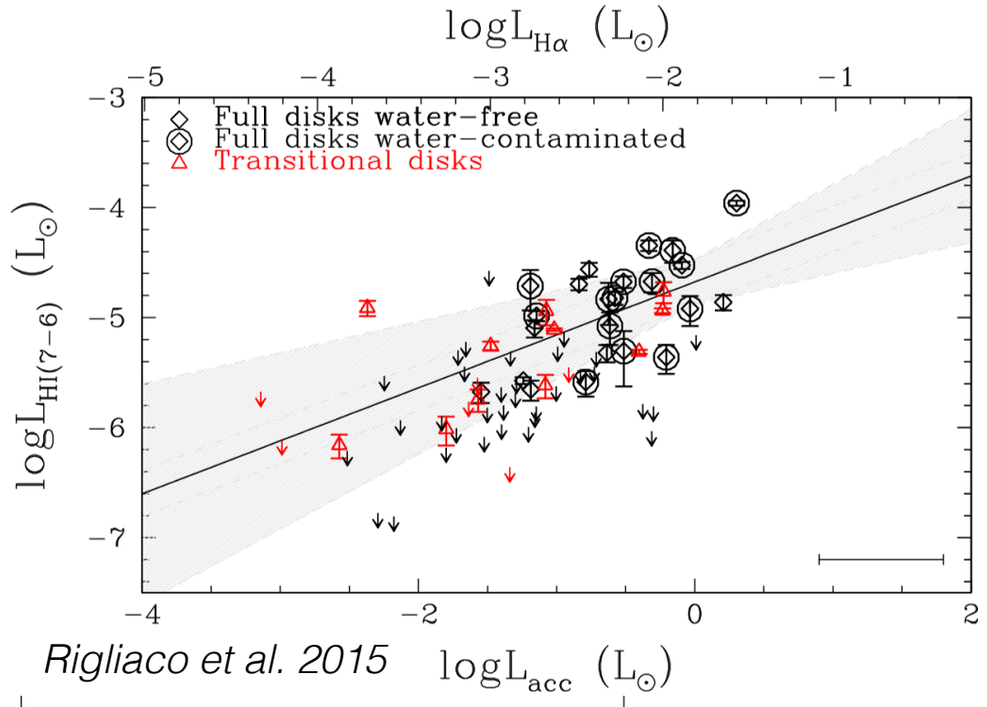

Rigliaco et al. 2015

Beuther et al. 2023

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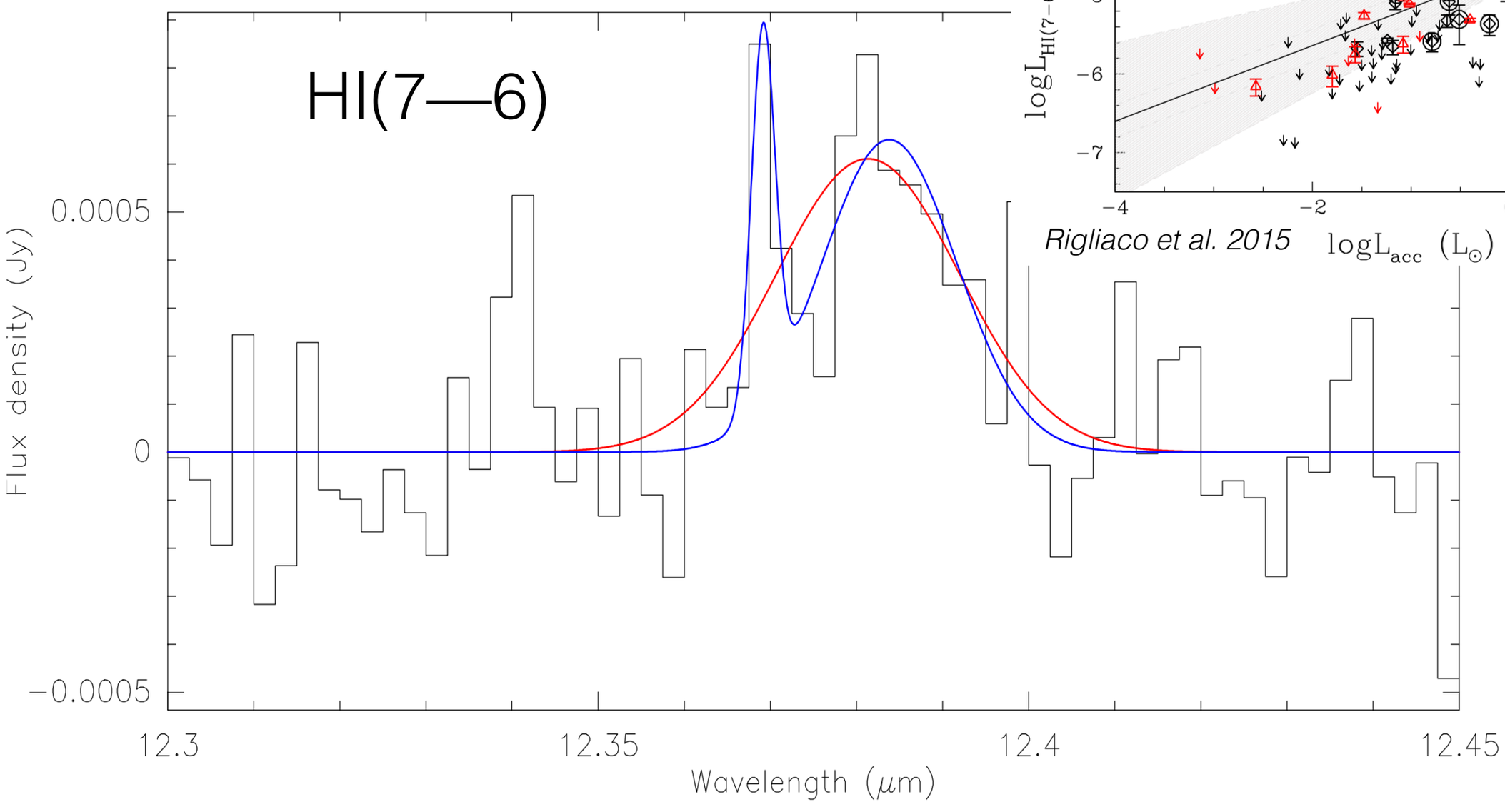
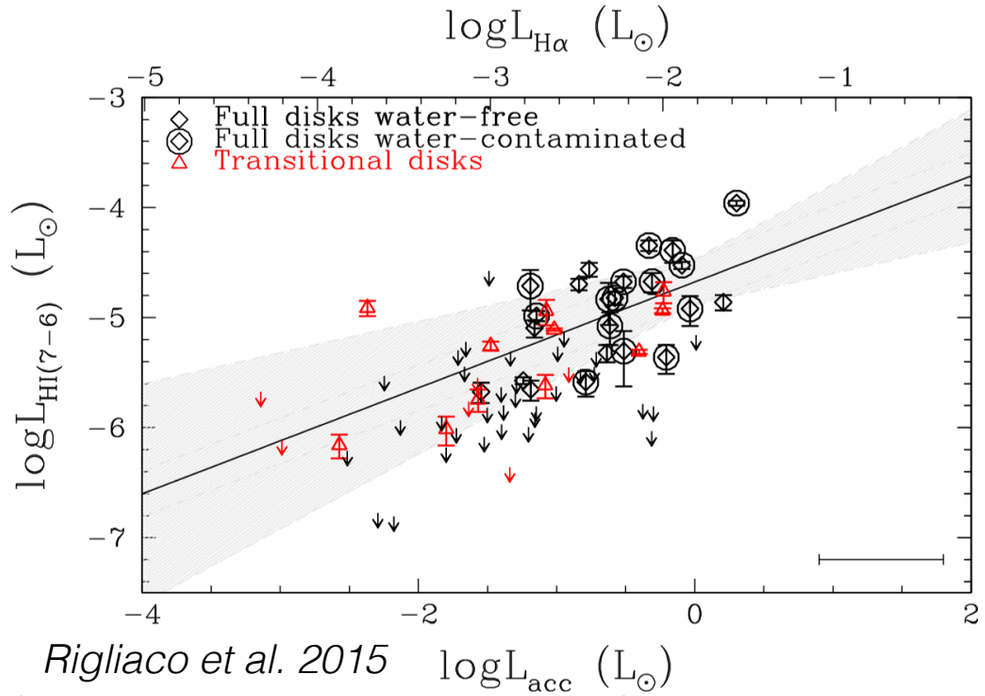


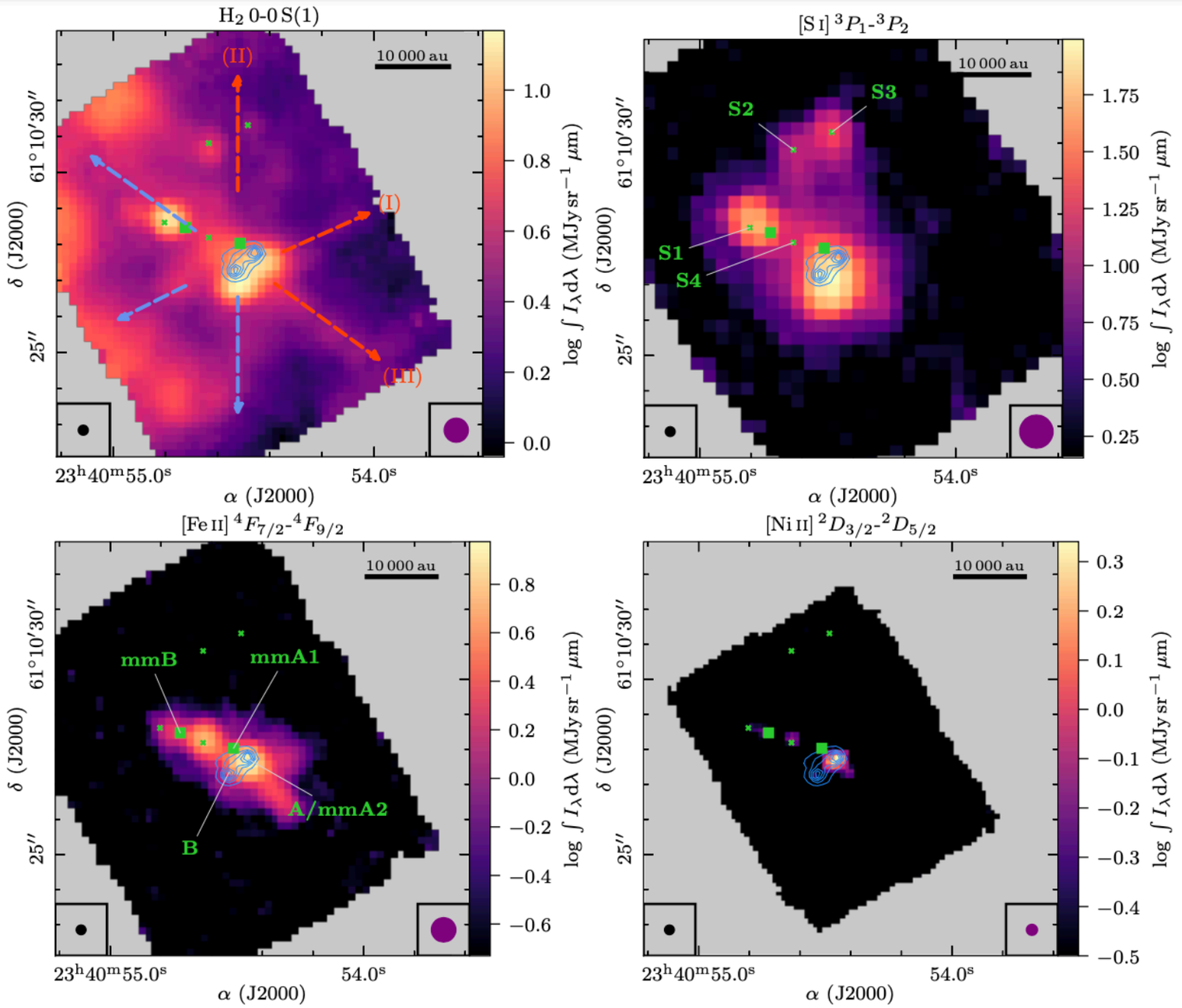


Rigliaco et al. 2015

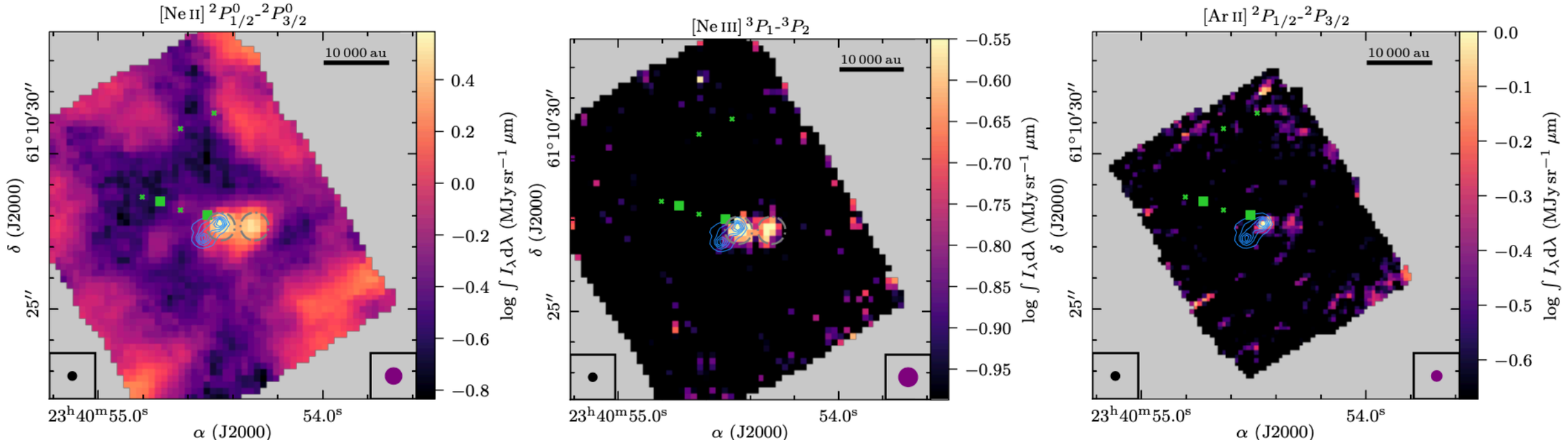
extinction correction —> Accretion rate around 10^{-4} $M_{sun}yr^{-1}$

Beuther et al. 2023

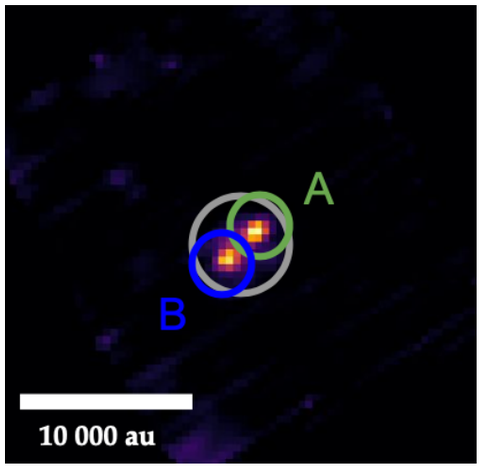
Atomic gas lines



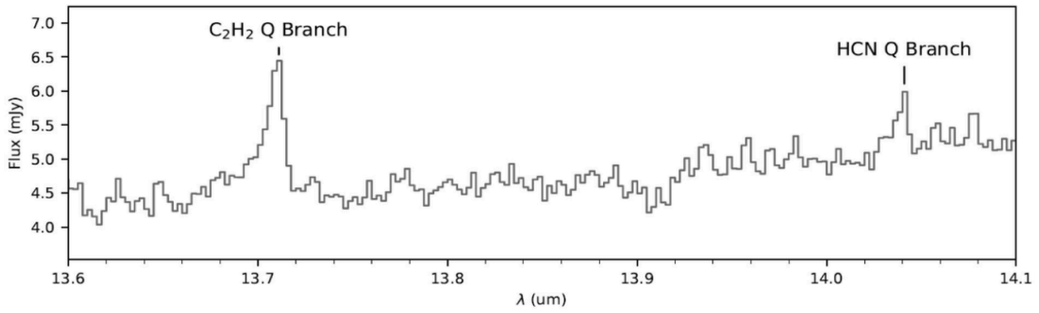
Gieser et al. 2023

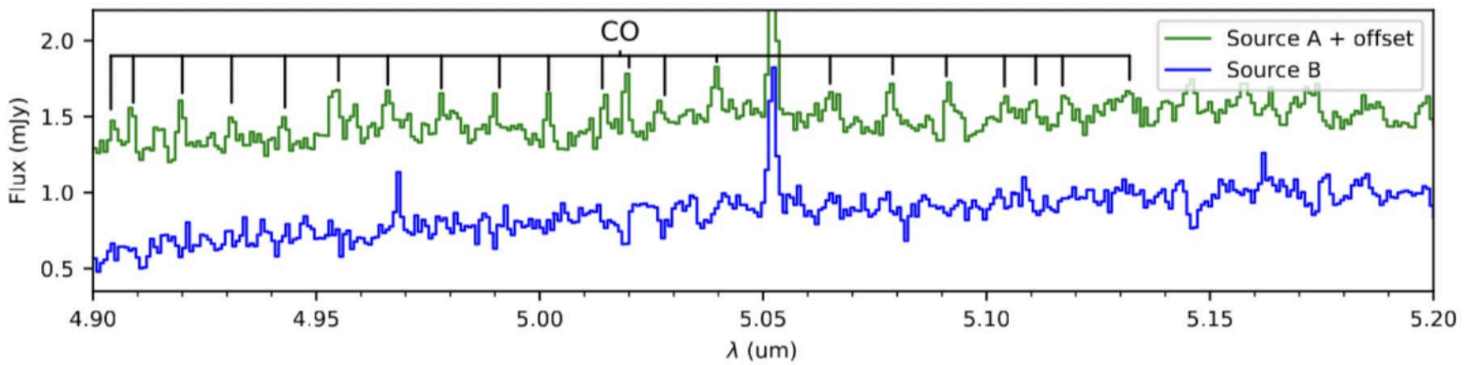


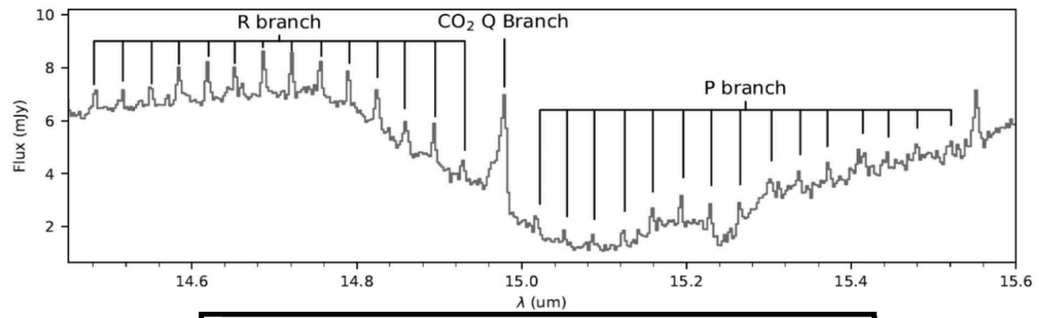
Molecular gas lines

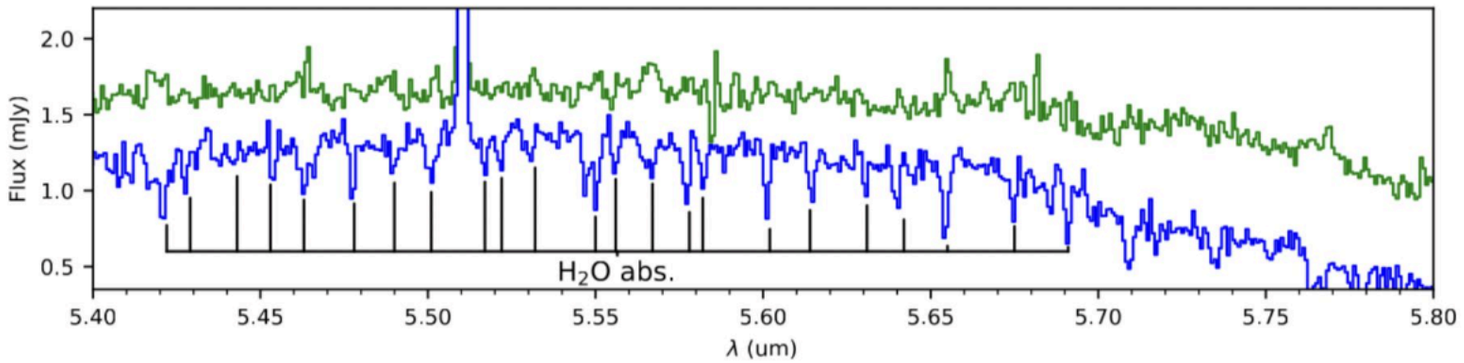


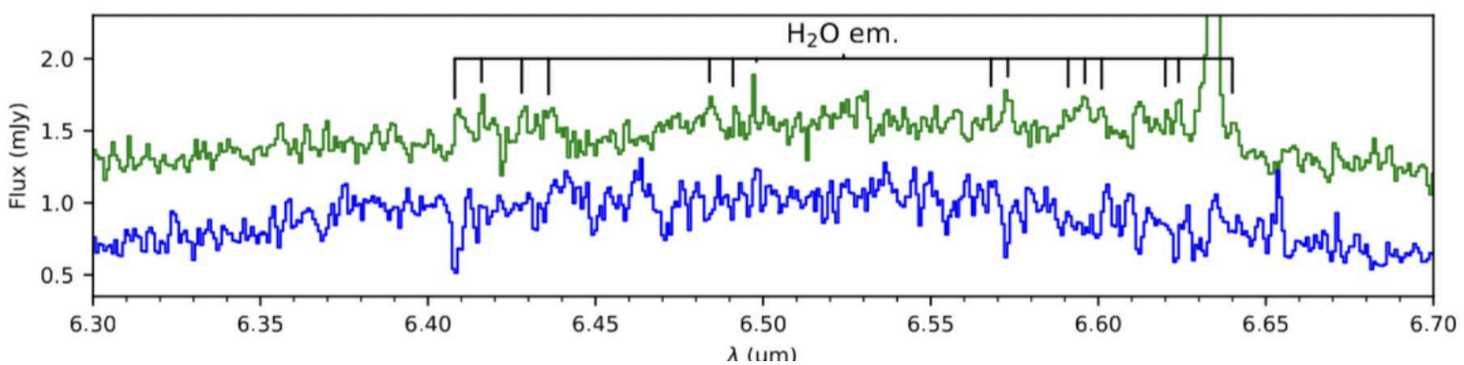
C_2H_2, HCN, CO_2, CO
CH_4, H_2O, H_2, HD, OH …

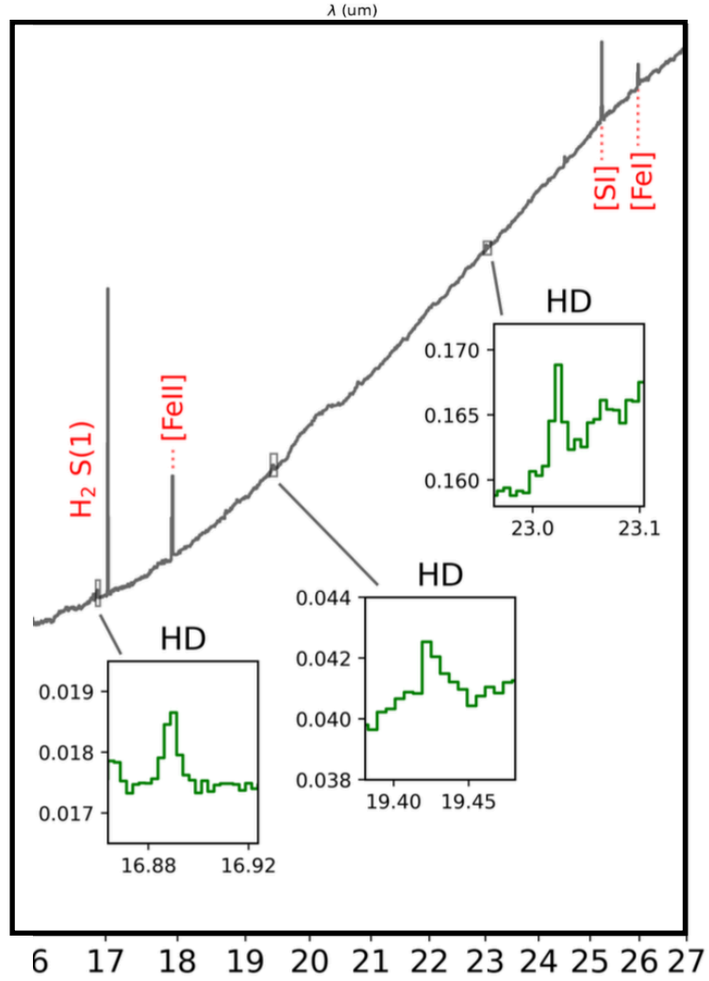








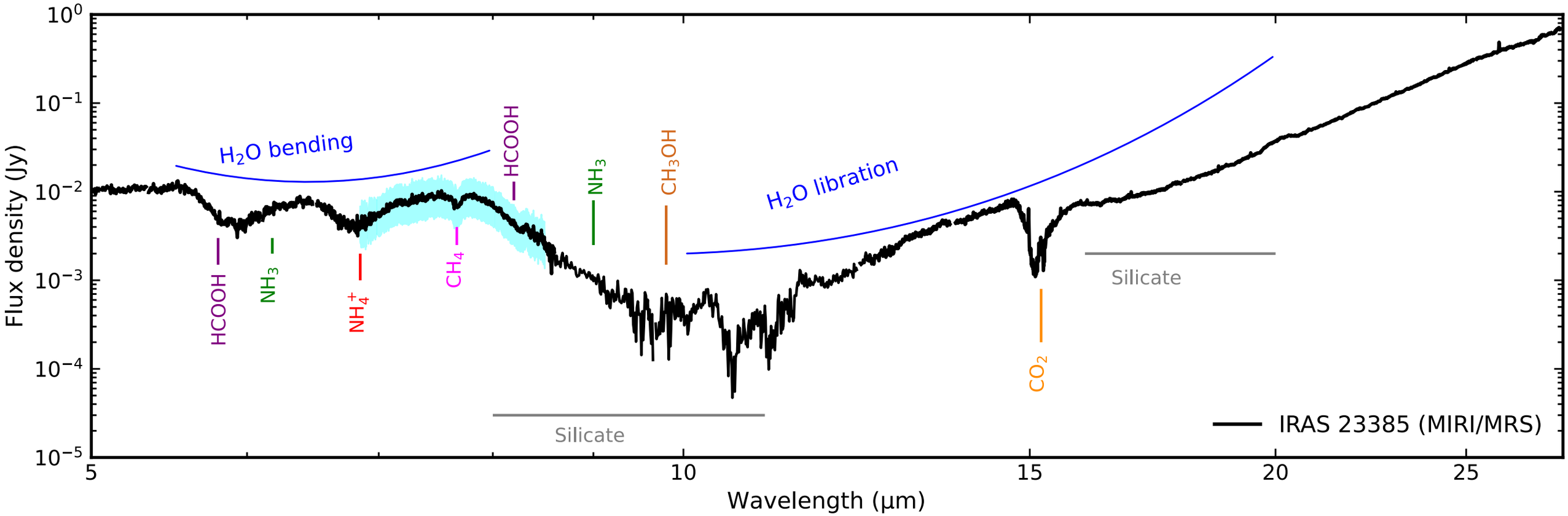




- C_2H_2, HCN, CO_2 around 150K
- CO & H_2O hotter —> 600 to 1000K

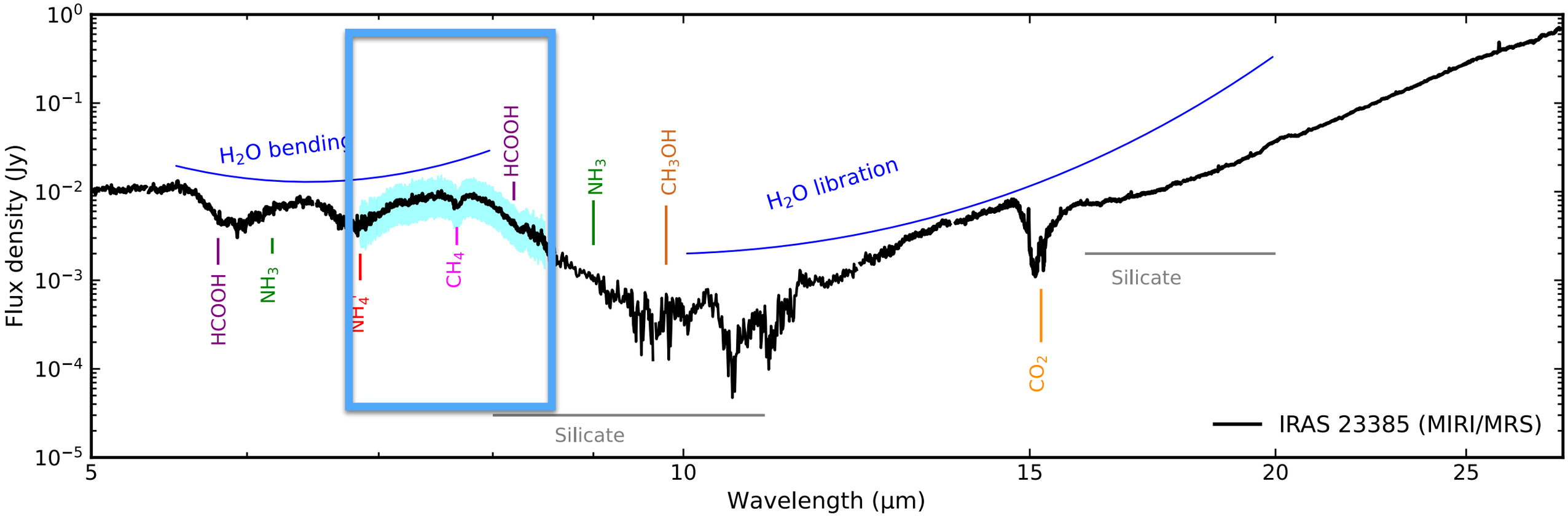
Francis et al. 2024

Ices



Rocha et al. 2024

Ices



Rocha et al. 2024

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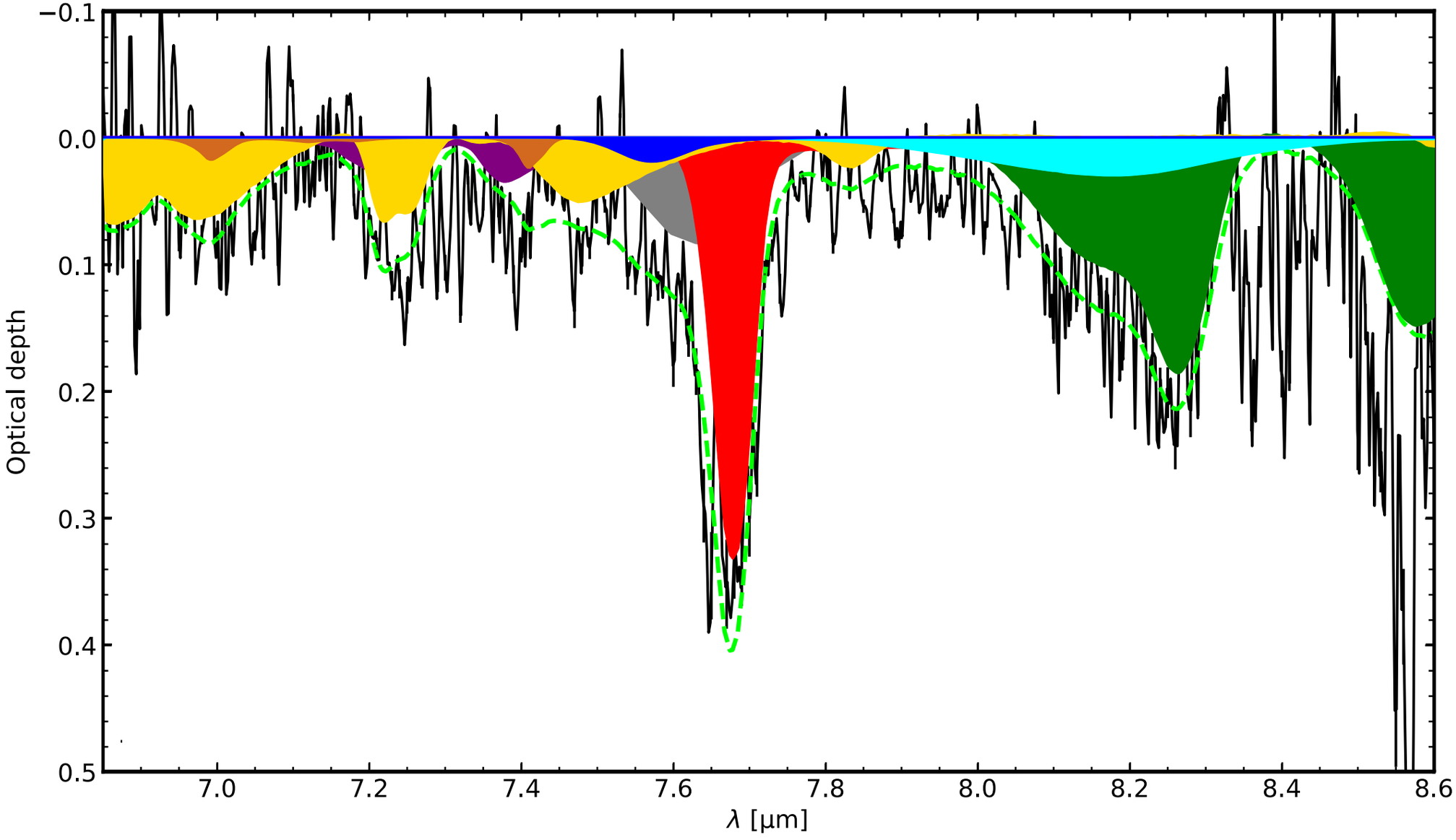


ENIIGMA fit

CH_4

OCN^-

SO_2

$HCOO^-$

CH_3CH_2OH

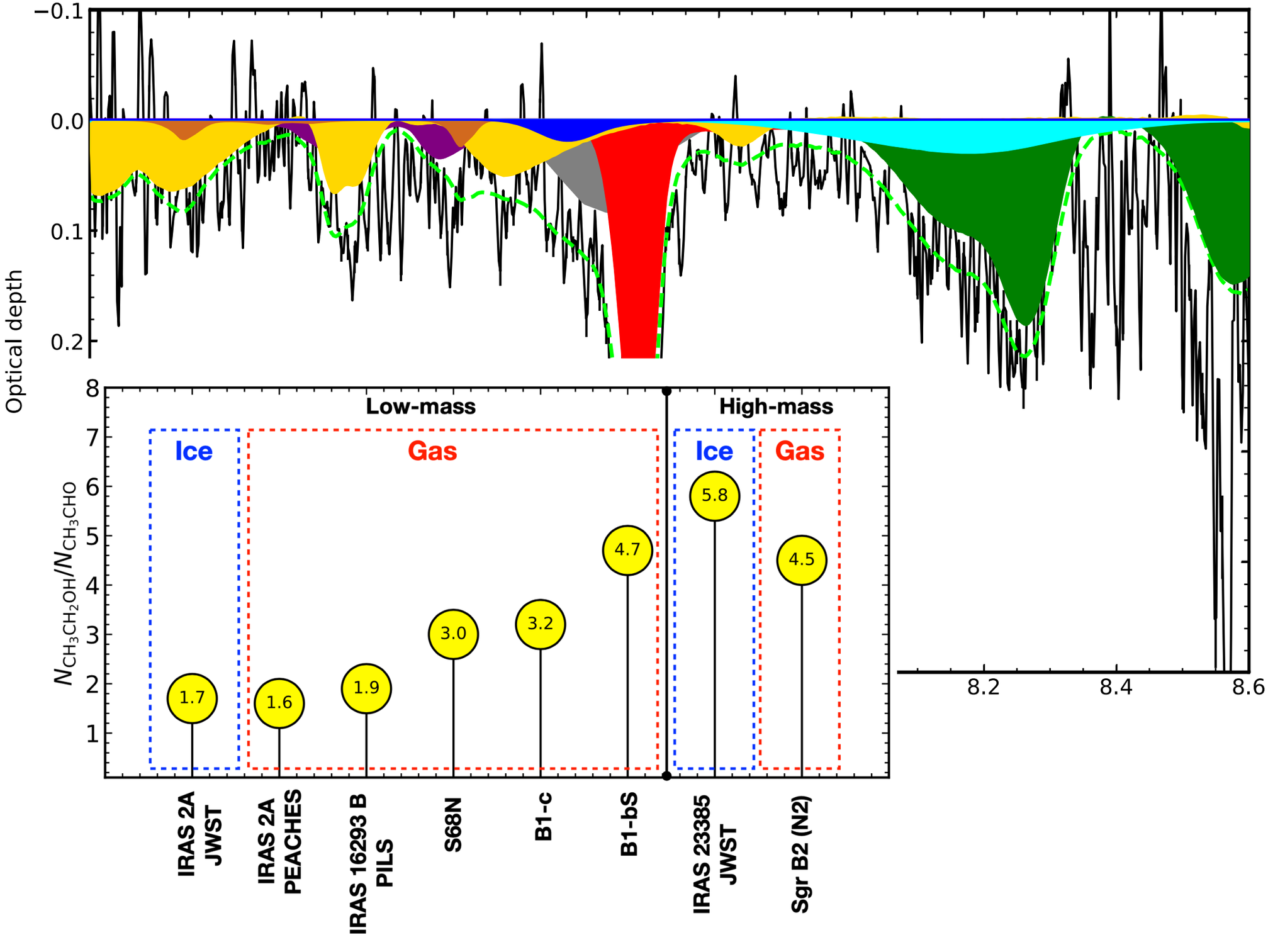
CH_3OCHO

HCOOH

CH_3CHO

Rocha et al. 2024

Ices



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Rocha et al. 2024

Main results

- Early JWST MRS data of high-mass star-forming region
  —> can serve as template region

- Two continuum sources resolved, not on mm peak

- H2, [FeII] and SiO data reveal at least three outflows

- Weak Humphreys alpha —> accretion rate estimates

- Physical parameters from diverse molecules

- Many ice features from COMs