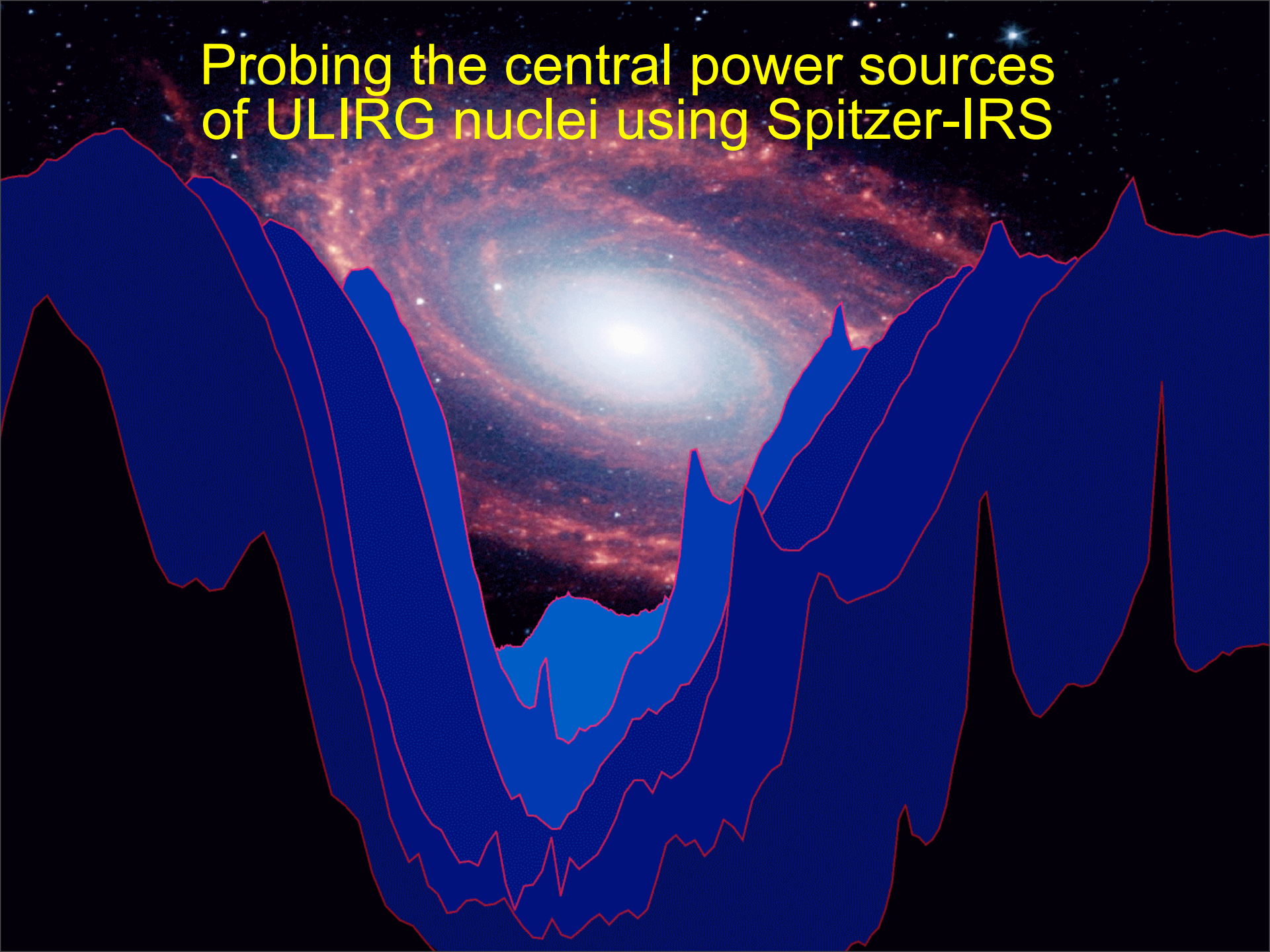
Probing the central power sources of ULIRG nuclei using Spitzer-IRS



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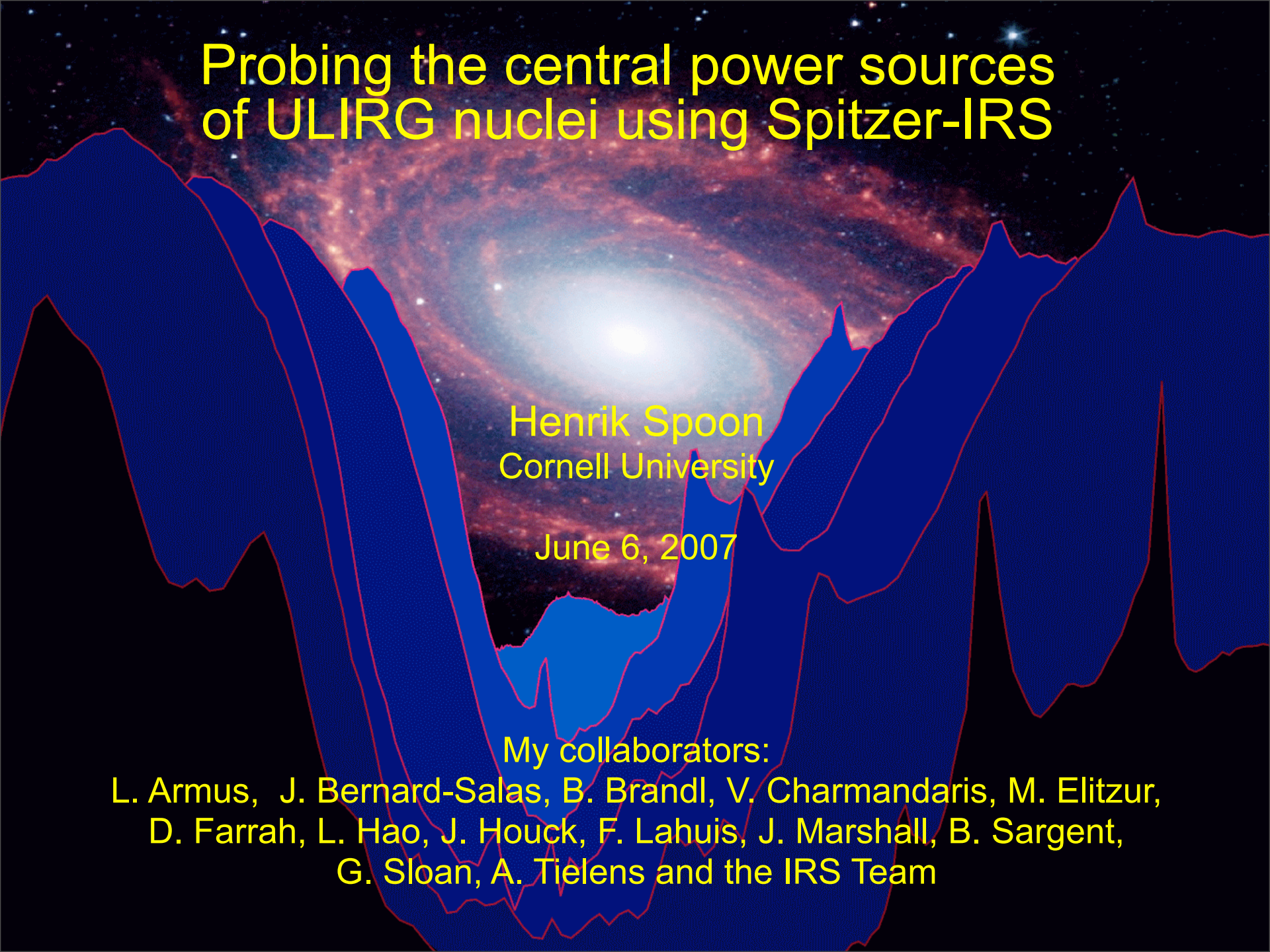

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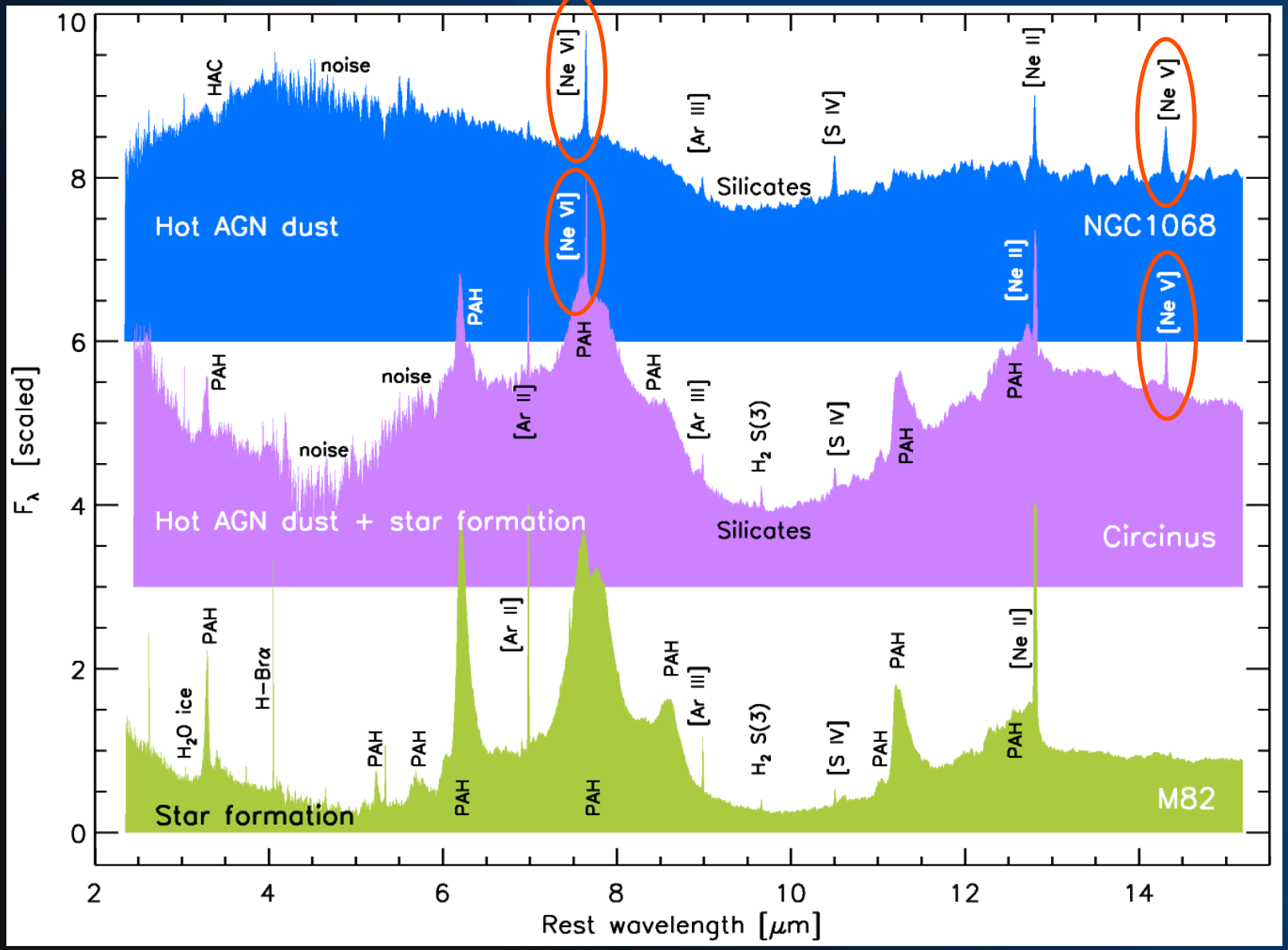
Cornell University

June 6, 2007

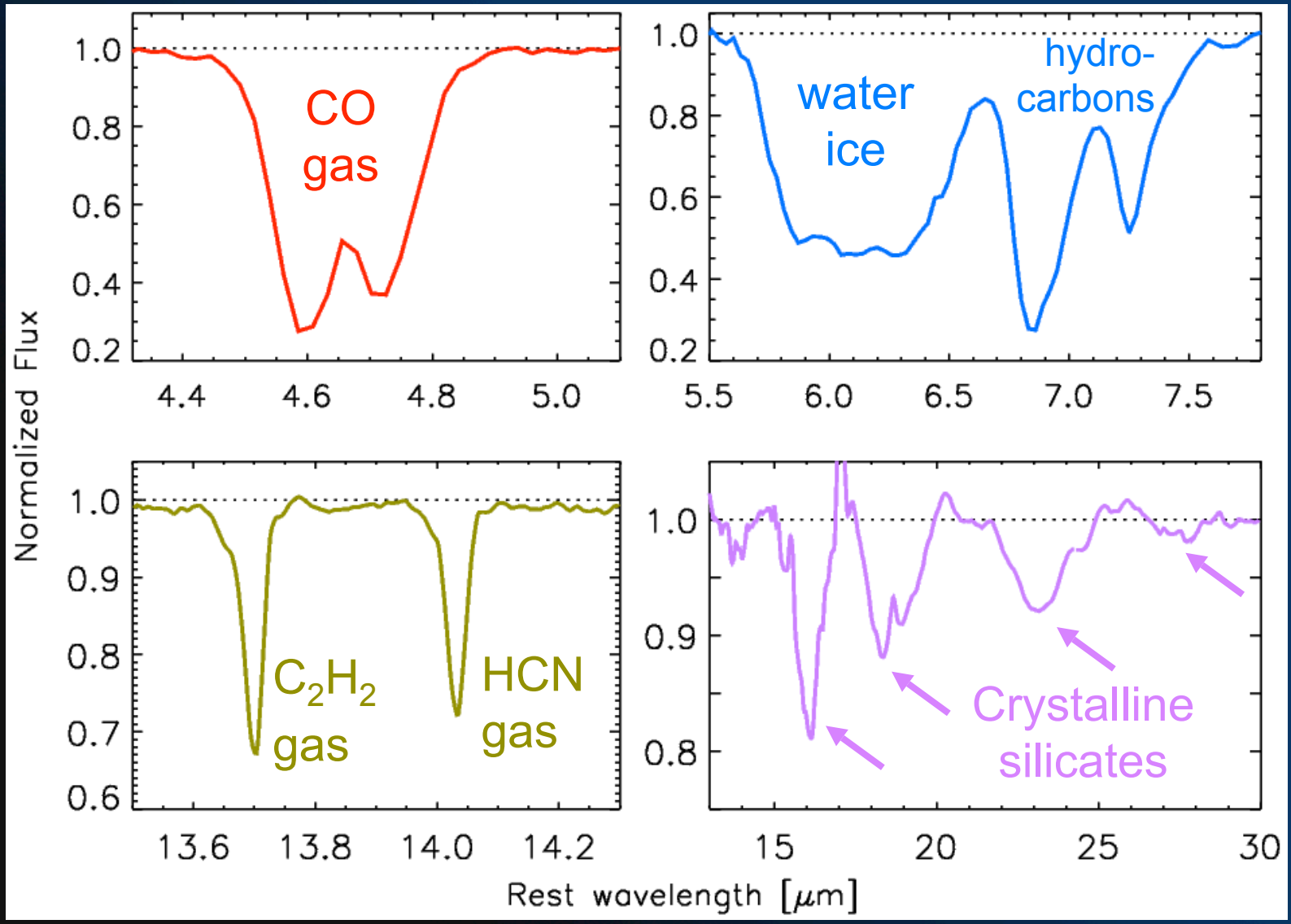
My collaborators:
L. Armus, J. Bernard-Salas, B. Brandl, V. Charmandaris, M. Elitzur, D. Farrah, L. Hao, J. Houck, F. Lahuis, J. Marshall, B. Sargent, G. Sloan, A. Tielens and the IRS Team

ISO-SWS extragalactic spectra

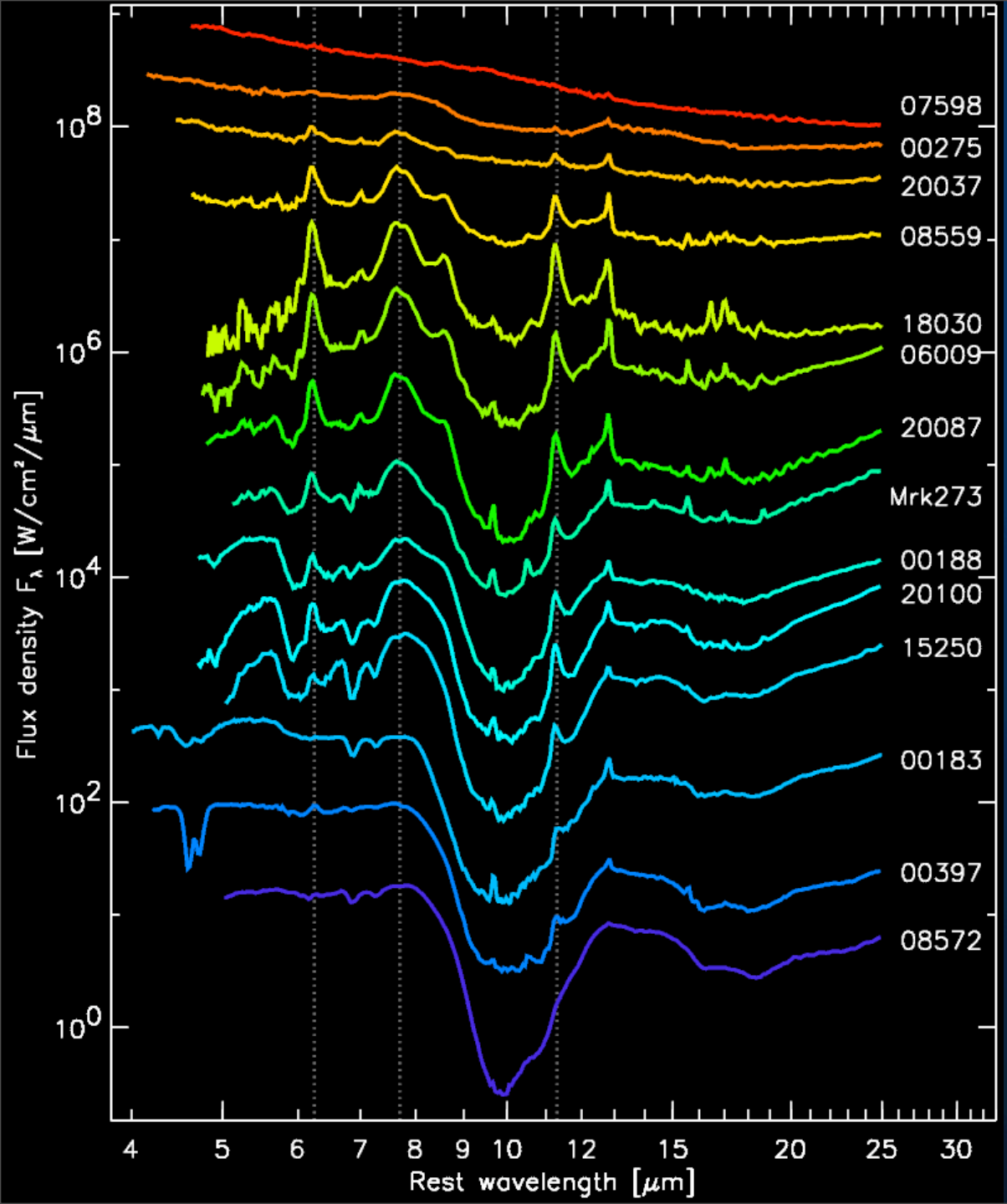


Data: Sturm et al. (2000)

Absorption features in (U)LIRG spectra



Spoon et al. (2005,2006)
Lahuis et al. (2007)

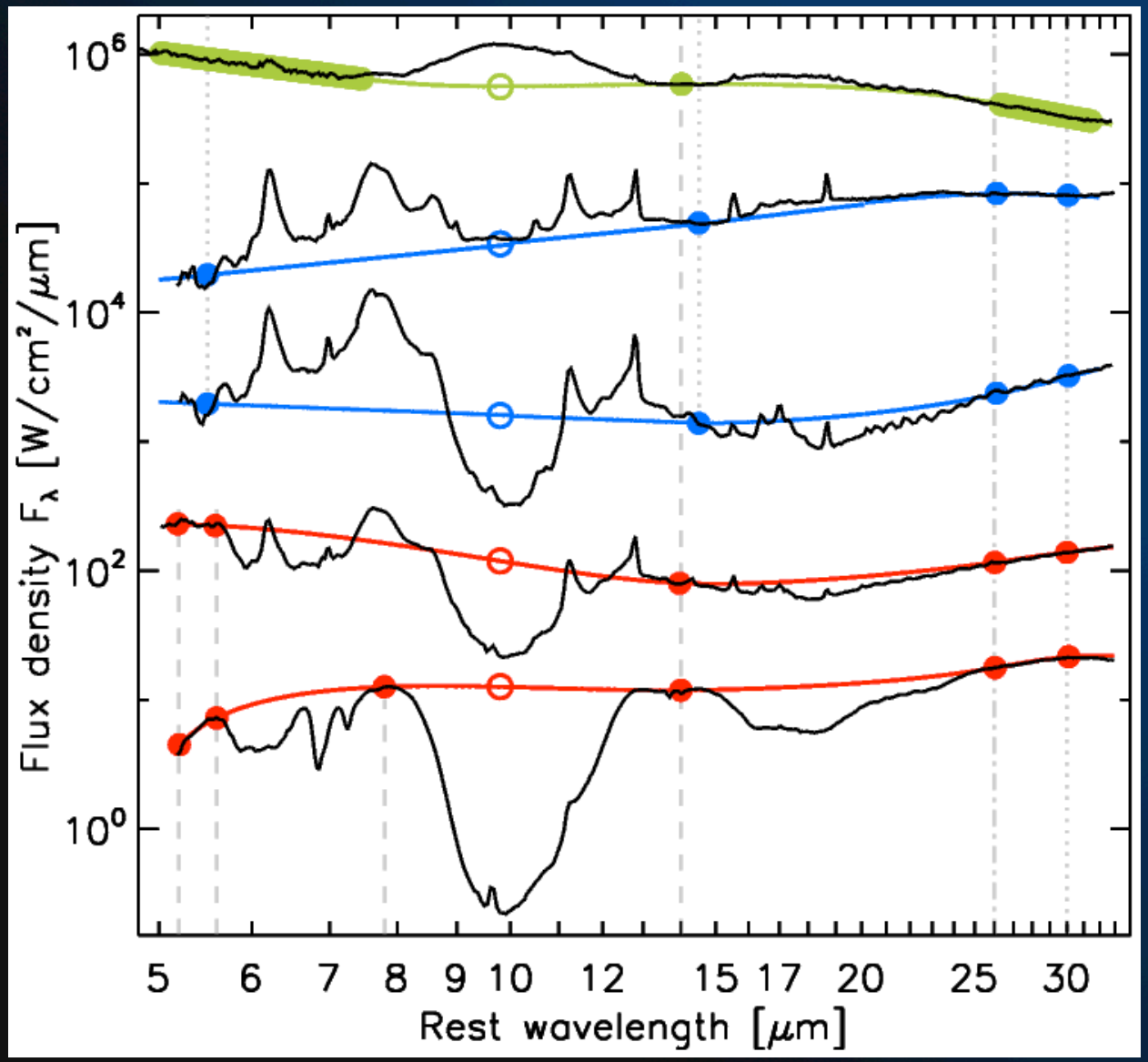


High S/N Spitzer-IRS spectra illustrate diverse nature

3 kinds of mid-IR SEDs:

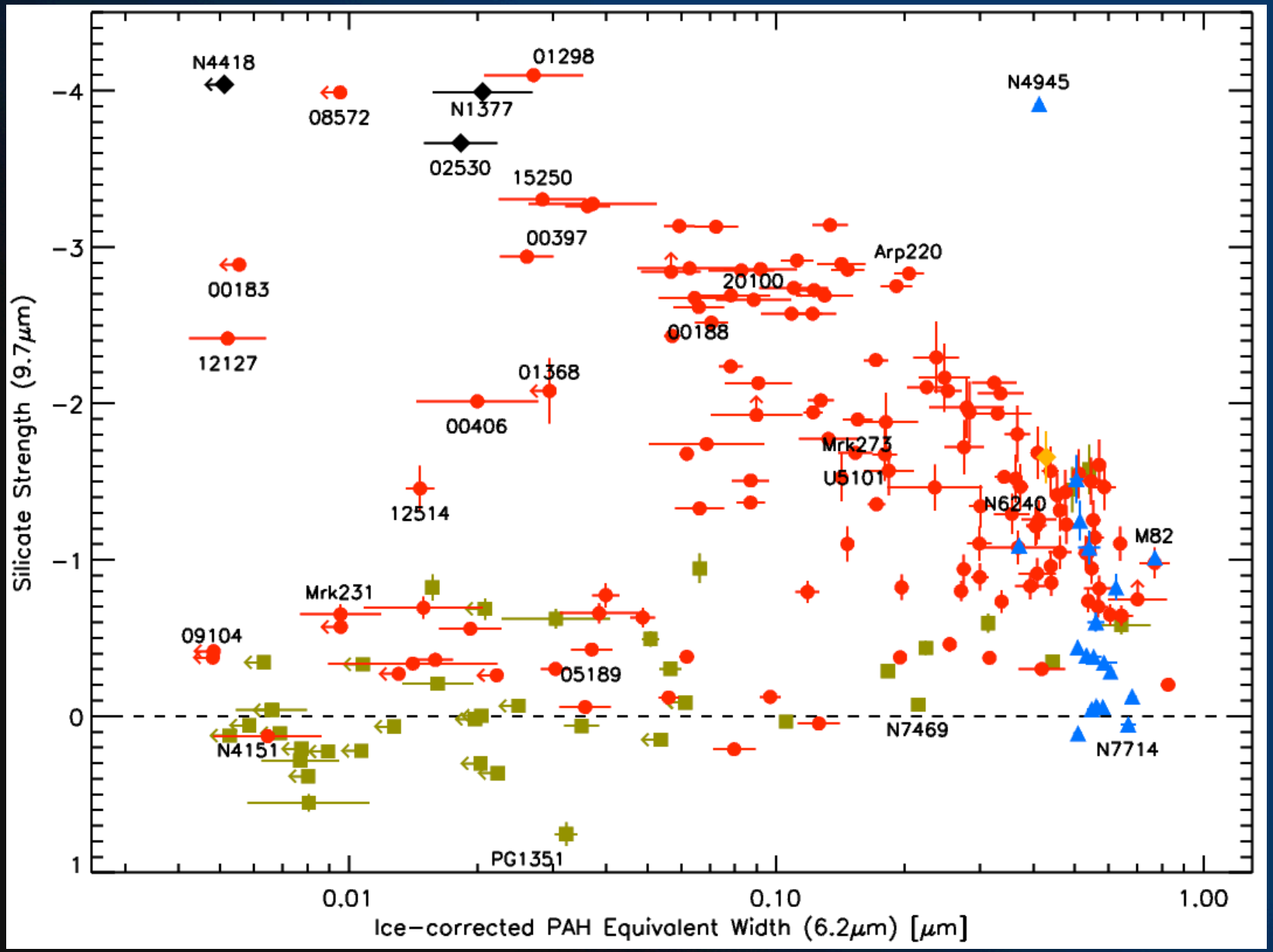
- AGN-dominated
- starburst-dominated
- absorption-dominated

Measuring the `Silicate strength'



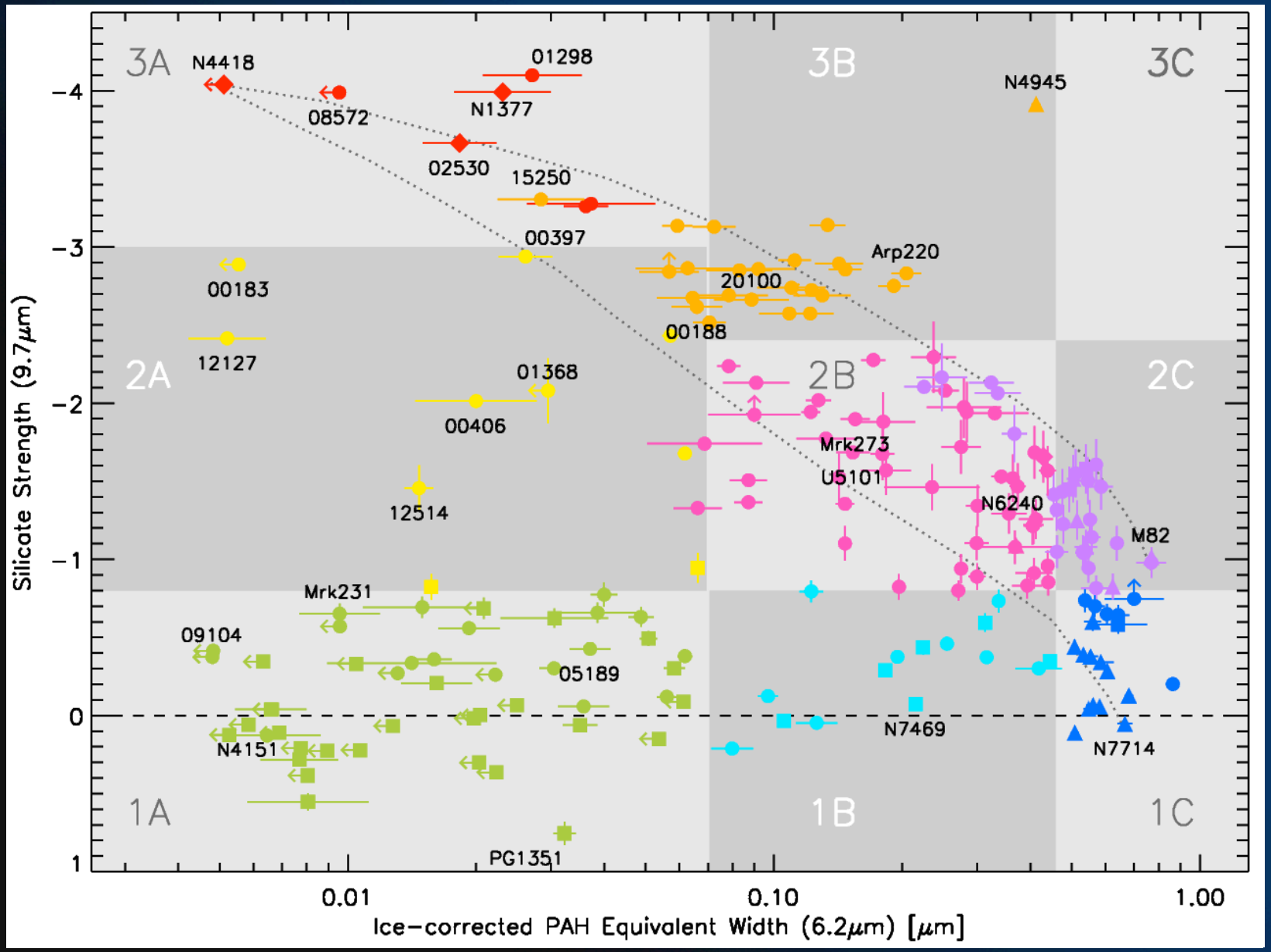
Spoon et al. (2007)

Mid-IR spectral classification



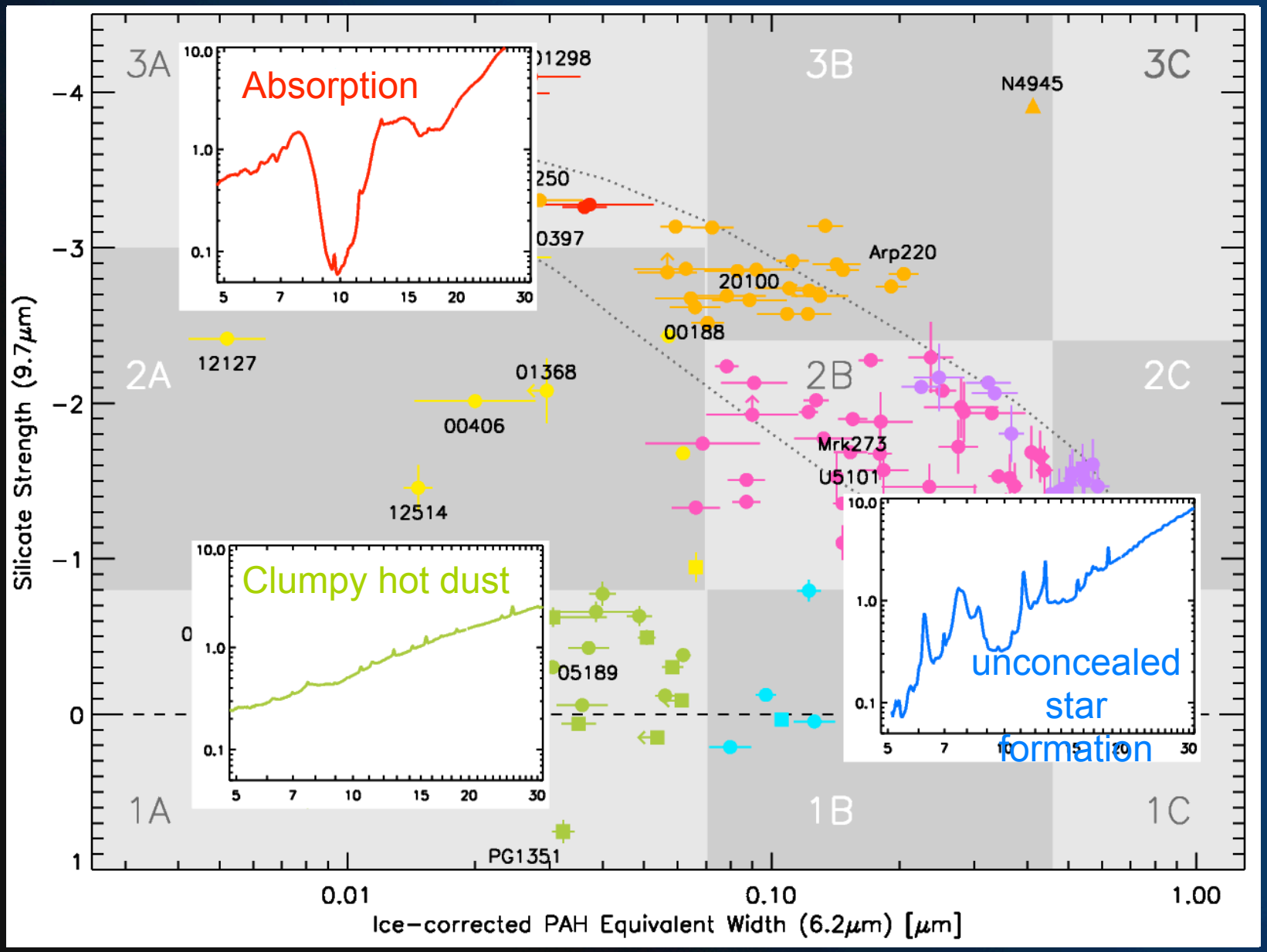
Spoon et al. (2007 & in prep.)

Mid-IR spectral classification



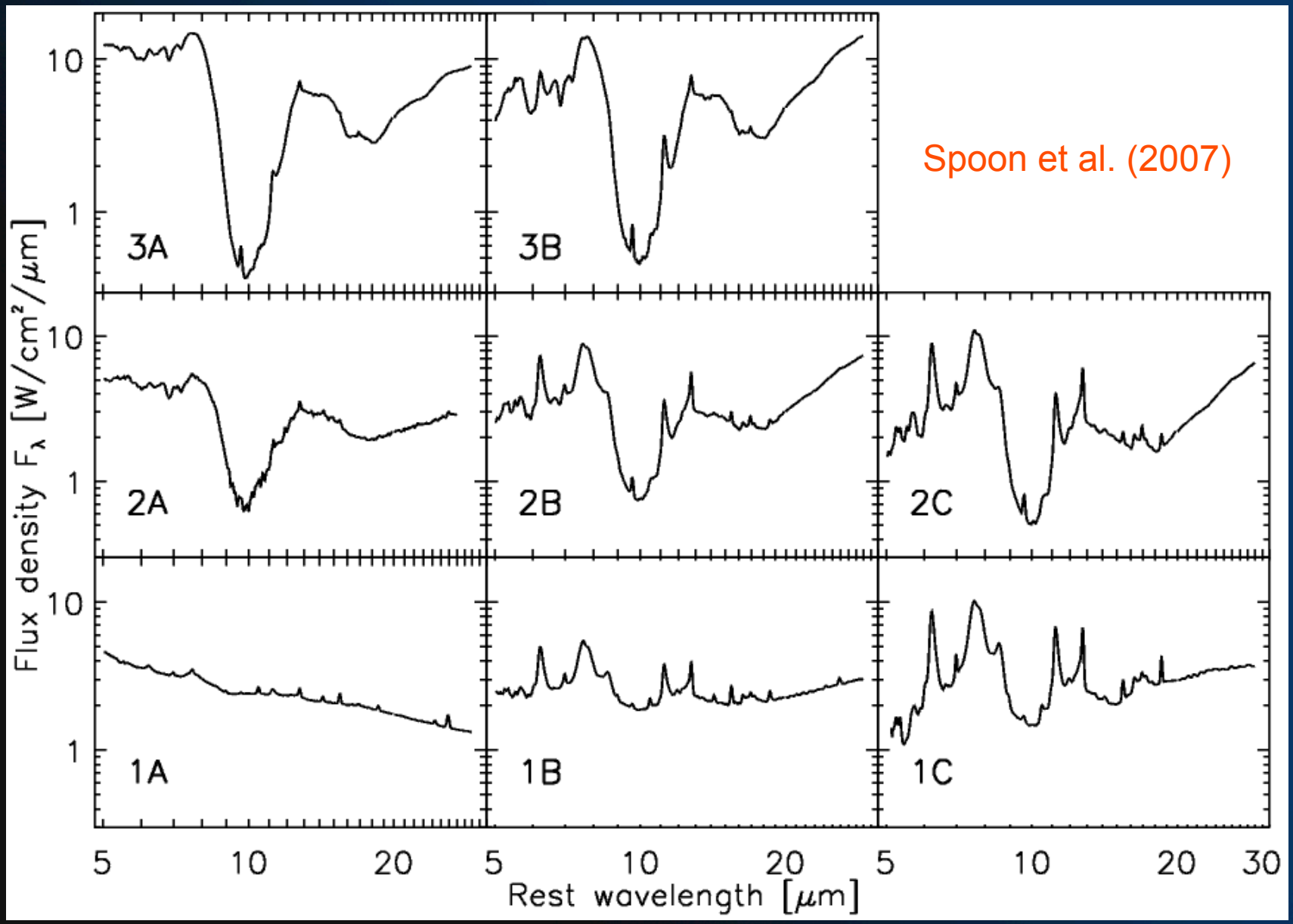
Spoon et al. (2007 & in prep.)

Mid-IR spectral classification

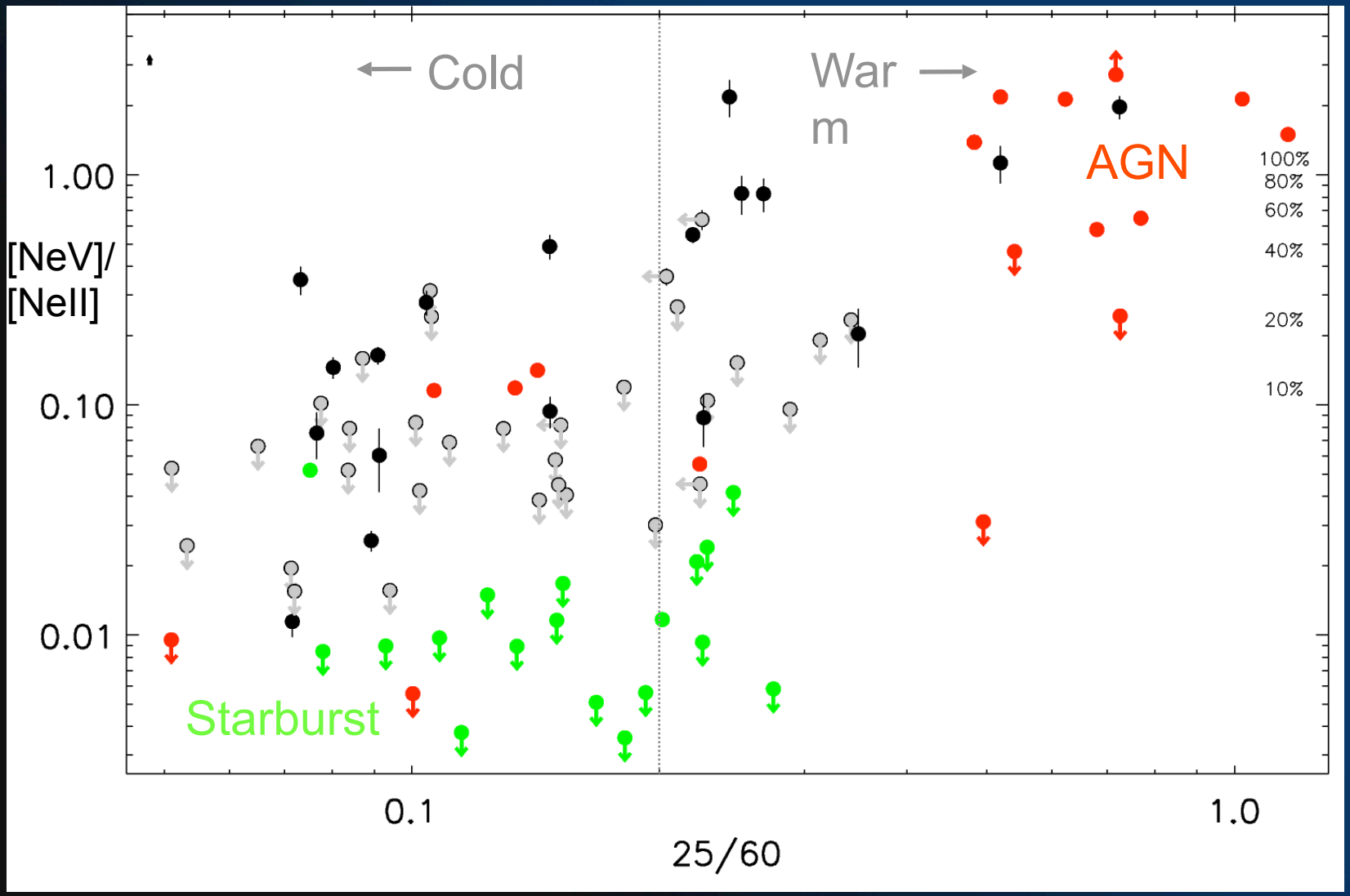


Spoon et al. (2007 & in prep.)

Average mid-IR galaxy spectra

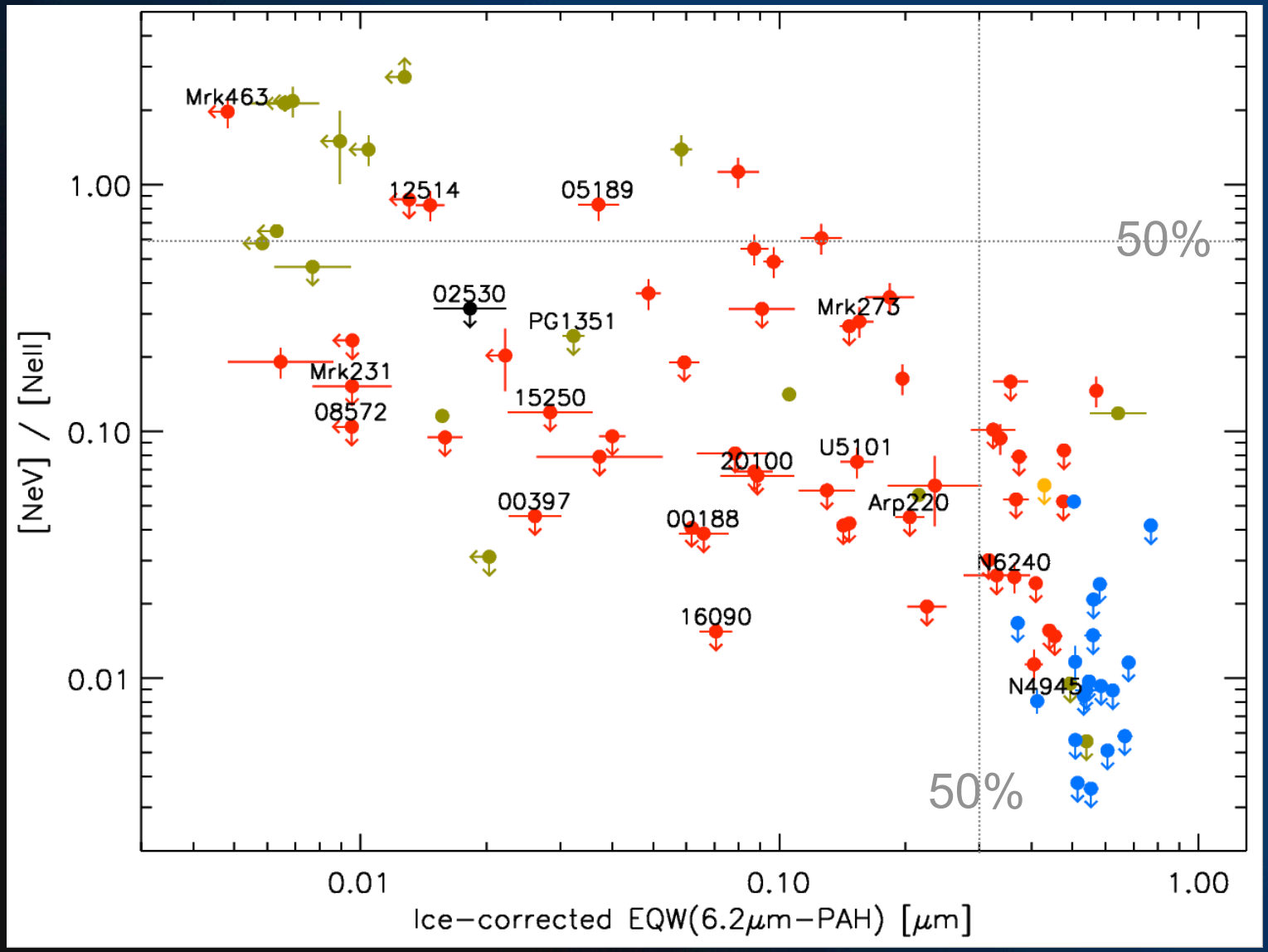


1/2 of warm and 1/3 of cold ULIRGs detected in [NeV]



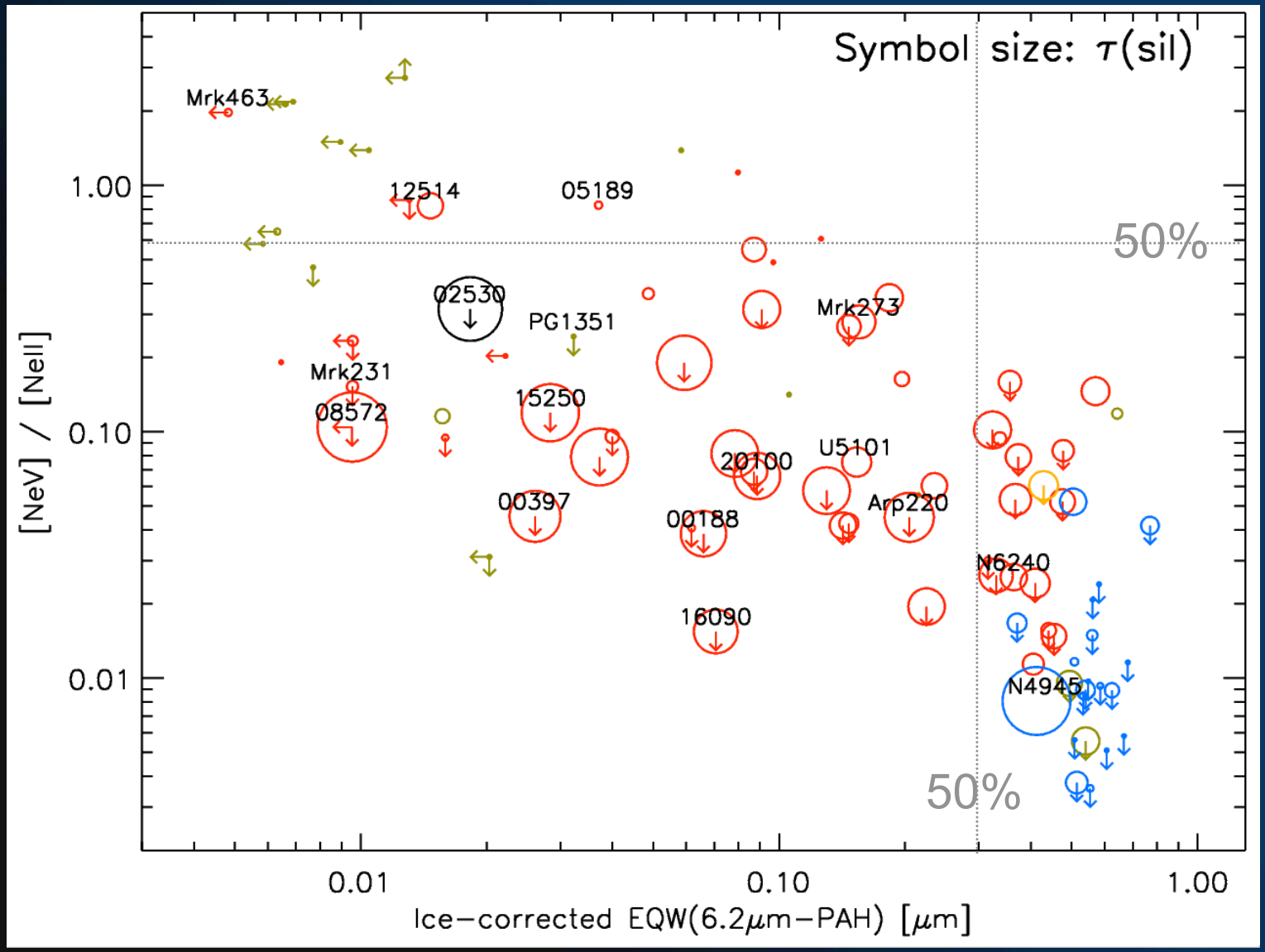
Farrah et al. (accepted)

Genzel diagram



Data: Farrah et al. (accepted)

Genzel diagram



Data: Farrah et al. (accepted)

Conclusions

- `Fork diagram' separates clumpy from non-clumpy obscuring geometries
- [NeV] detected in 22/53 ULIRGs; in 10/20 luminous ULIRGs
- [Ne V] not detected toward dusty (silicate strength < -2) ULIRG nuclei
  ➔ AGN too deeply obscured or not energetically important ?
- Star formation tracer [Ne II] weaker toward dusty ULIRG nuclei
  ➔ starburst more embedded ?
- CO, HCN and C_2H_2 gas absorption features trace warm and dense ISM
  ➔ close to AGN or central starburst ?
- Crystalline silicates trace freshly injected silicates
  ➔ presence of recent starburst (massive stars)