

The Infrared Database of Extragalactic Observables from Spitzer

The logo for IDEOS (The Infrared Database of Extragalactic Observables from Spitzer) features the word "IDEOS" in large, bold, blue letters. The letters are set against a background of a spectral plot. The plot shows a white line representing a spectrum with several peaks, and a green line representing a different spectrum. The background is a dark blue gradient with a subtle image of a galaxy or nebula. The entire logo is contained within a dark blue rounded rectangle.

IDEOS

IDEOS collaborators:

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John Miles

David Rupke

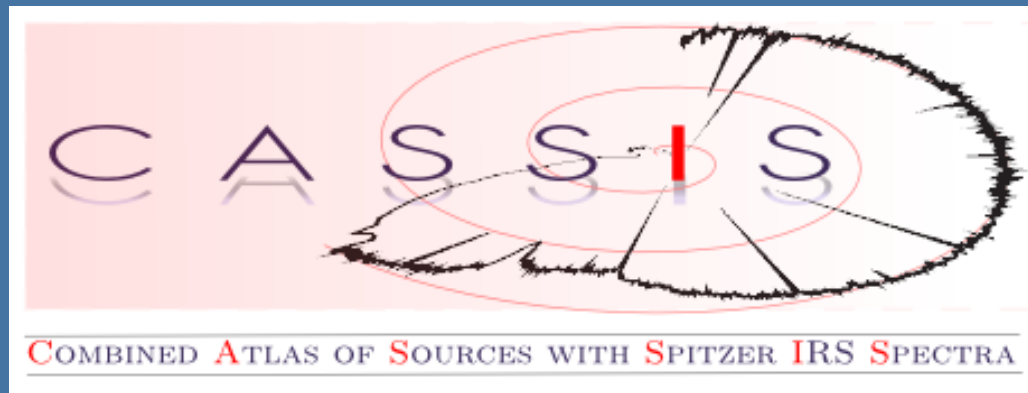
NASA-ADAP grants 2012 & 2015

The Infrared Database of Extragalactic Observables from Spitzer

The logo for IDEOS (The Infrared Database of Extragalactic Observables from Spitzer) features the acronym in large, bold, blue letters. The 'E' is highlighted in a golden-yellow color. The background is a dark blue gradient with a white line plot showing a spectral energy distribution with several peaks, and a green line plot below it. The entire logo is set within a dark blue rounded rectangle.

IDEOS

- **Observables for 3500 IRS low-resolution galaxy spectra:**
- **Line fluxes for 18 lines**
- **Fluxes and equivalent widths for 14 PAH bands**
- **9.7 μm silicate strength**
- **crystalline silicate strengths for 4 bands**
- **6 μm water ice; 6.85 μm hydrocarbon band**
- **Synthetic photometry for 15 Spitzer, WISE and JWST-MIRI bands**



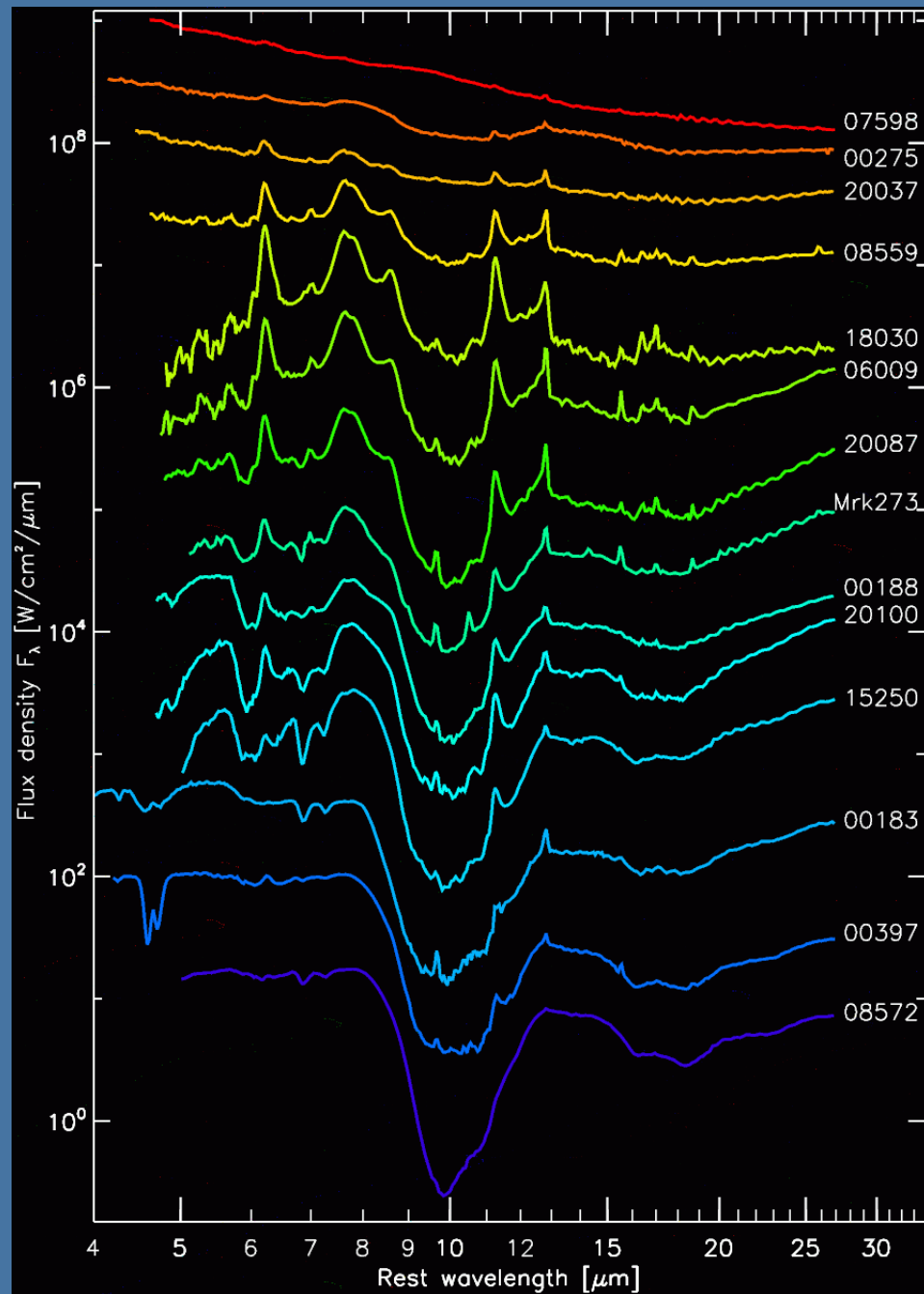
13,500 CASSIS spectra \rightarrow 3,500 IDEOS spectra:

- select all *galaxy* spectra from CASSIS
- discard poor S/N spectra
- choose optimal or tapered extraction based on source size
- match IRS source to NED source within IRS error circle
- obtain spectroscopic redshift: z_{NED} or z_{IRS} .
(124 galaxies had wrong z_{NED} . 228 got their first redshift: z_{IRS})
- combine spectral segments from different observations
- Scale and stitch spectral segments

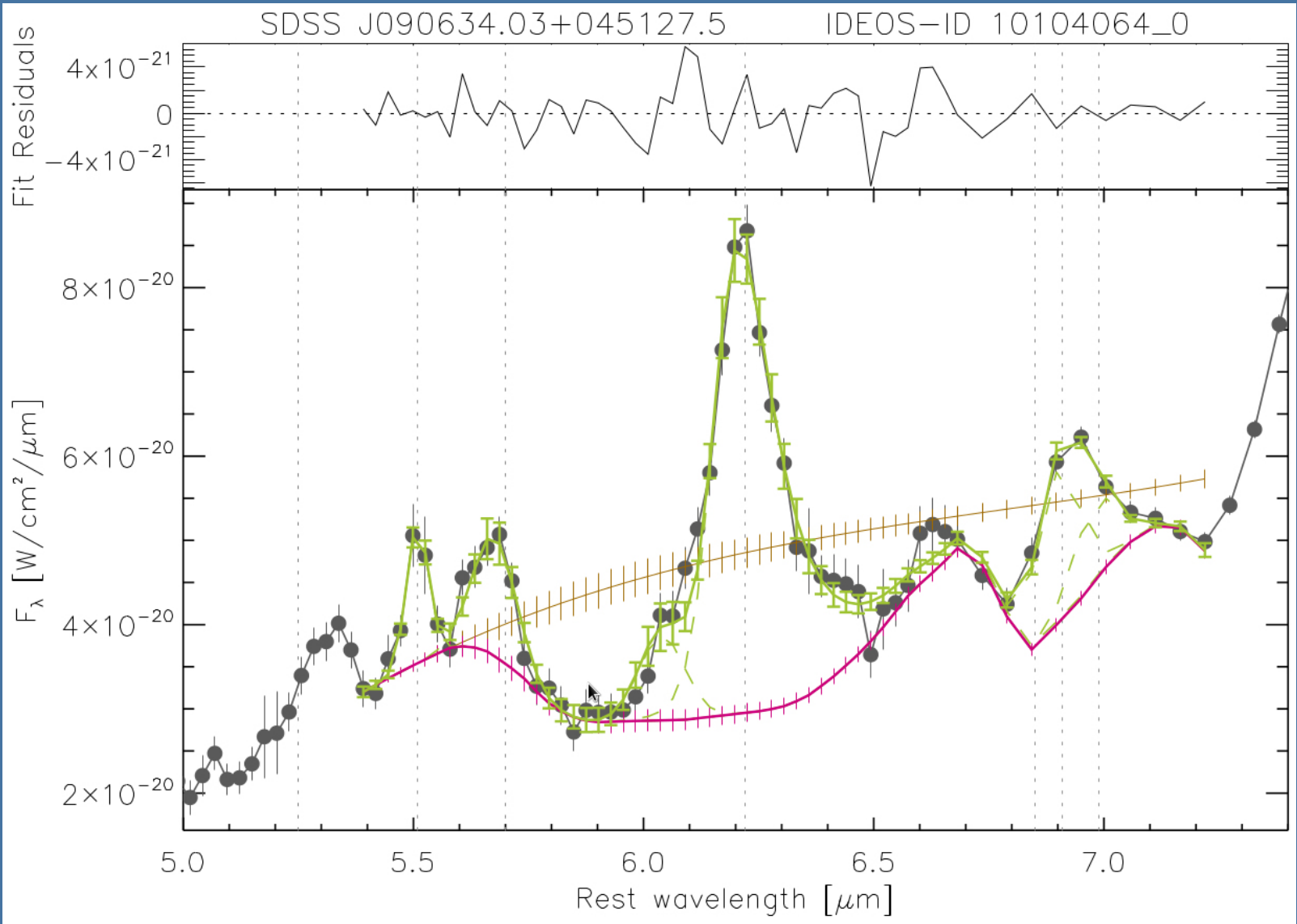
Challenge:

Fit model should accommodate many different features that:

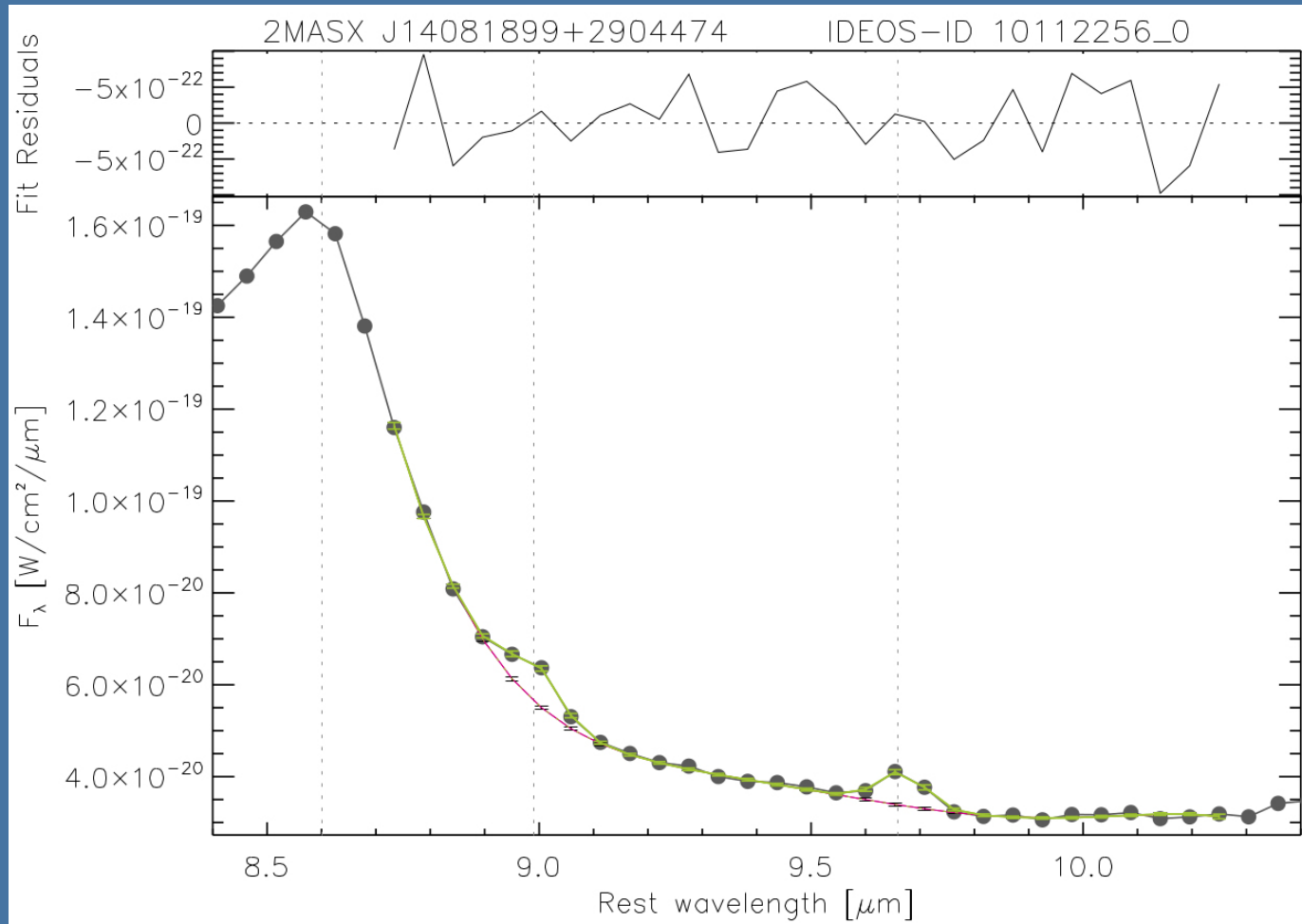
- overlap
- appear only in a fraction of sources
- Continuum needs to be very accurate to measure lines!



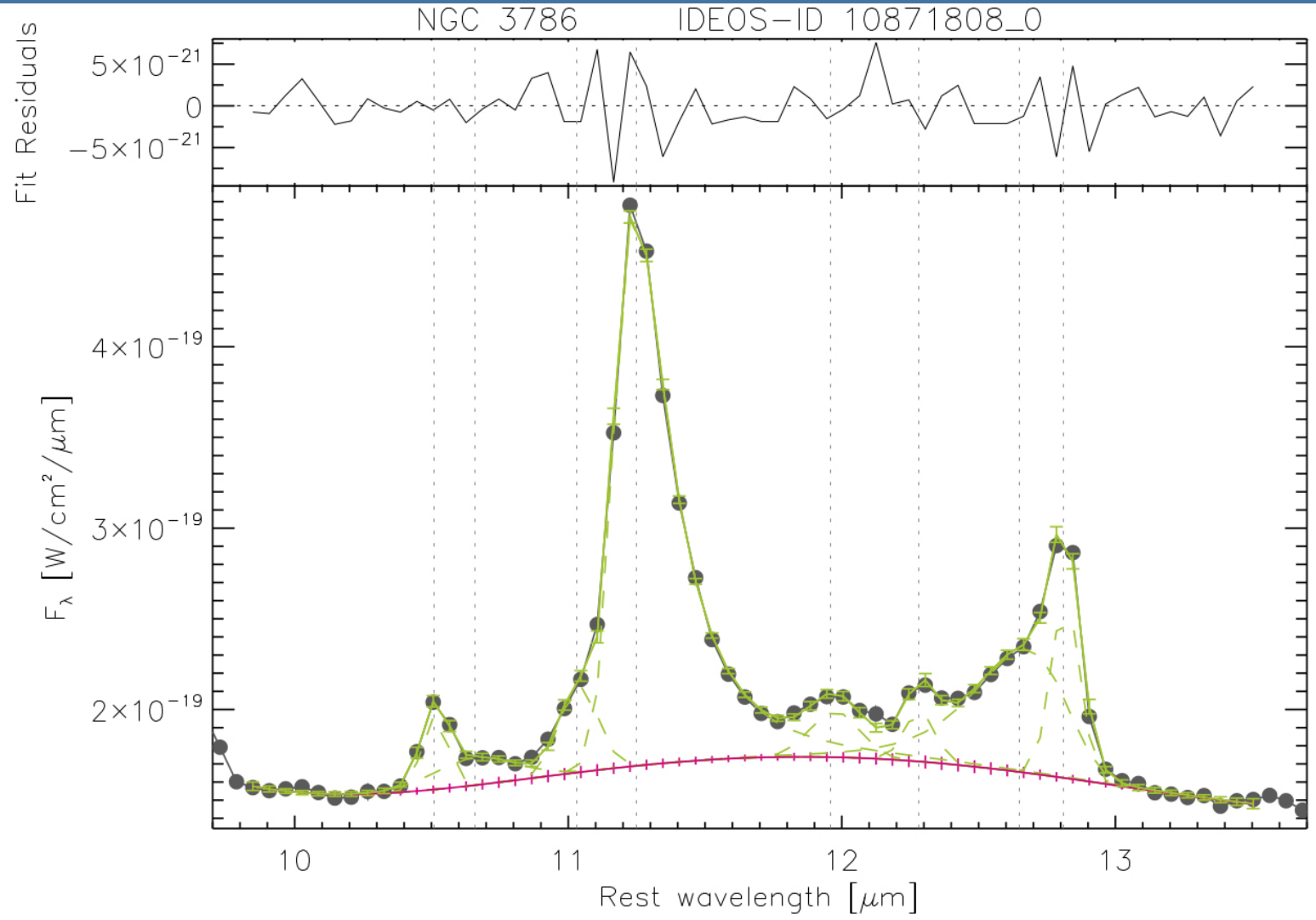
MPFIT model of 5.4-7.2 μm range



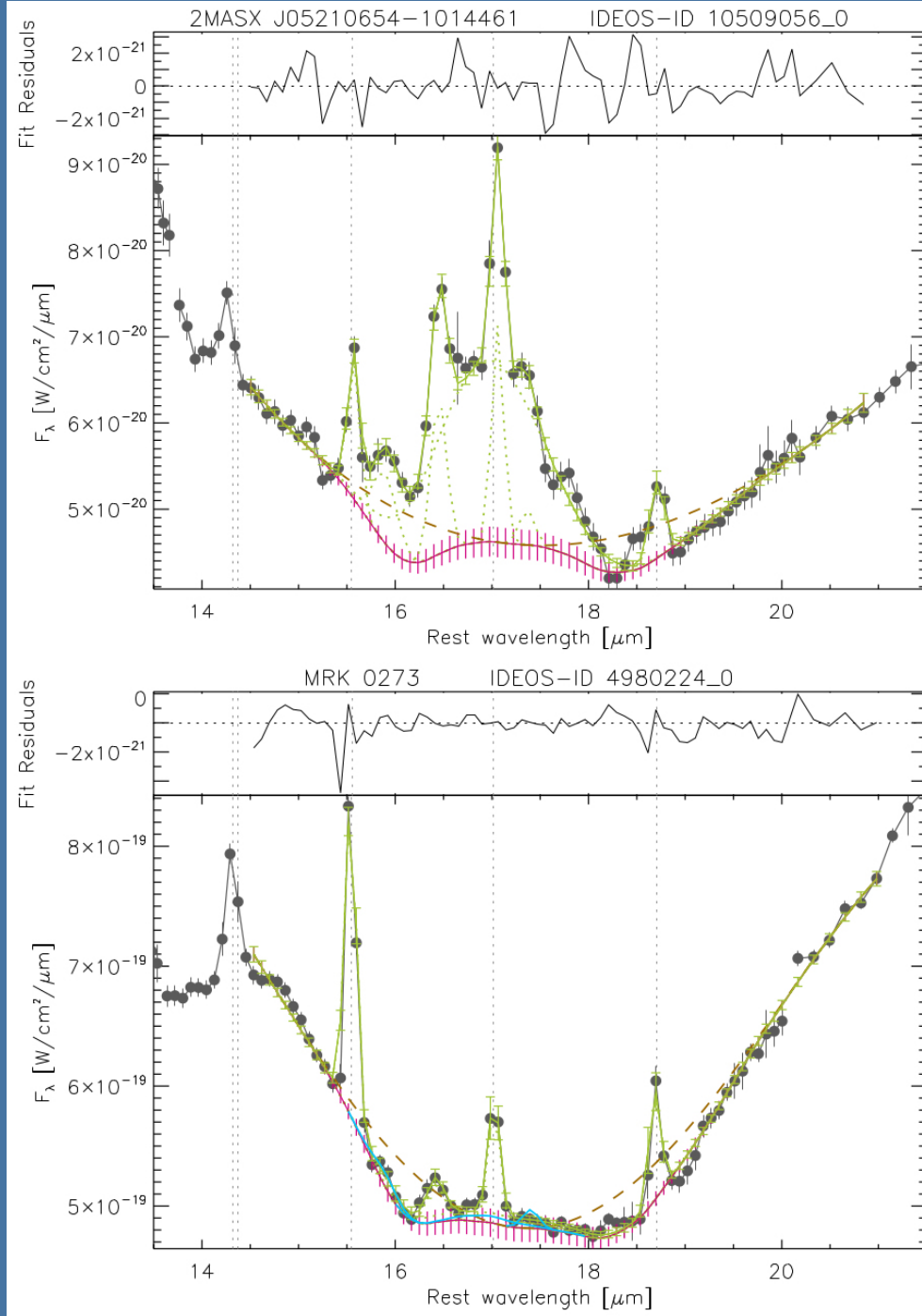
8.6-10 μ m range



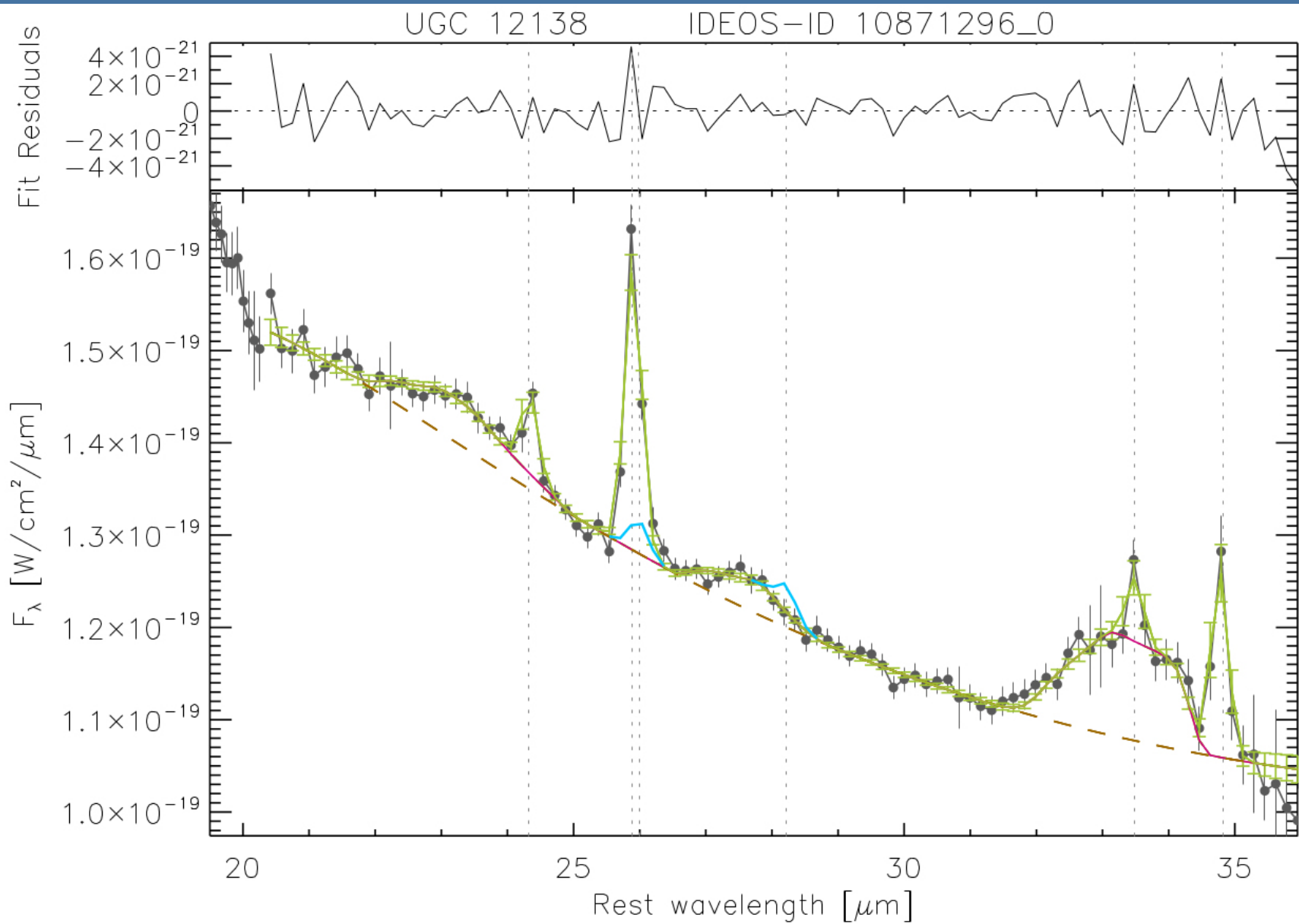
9.8-13.5 μm range fit



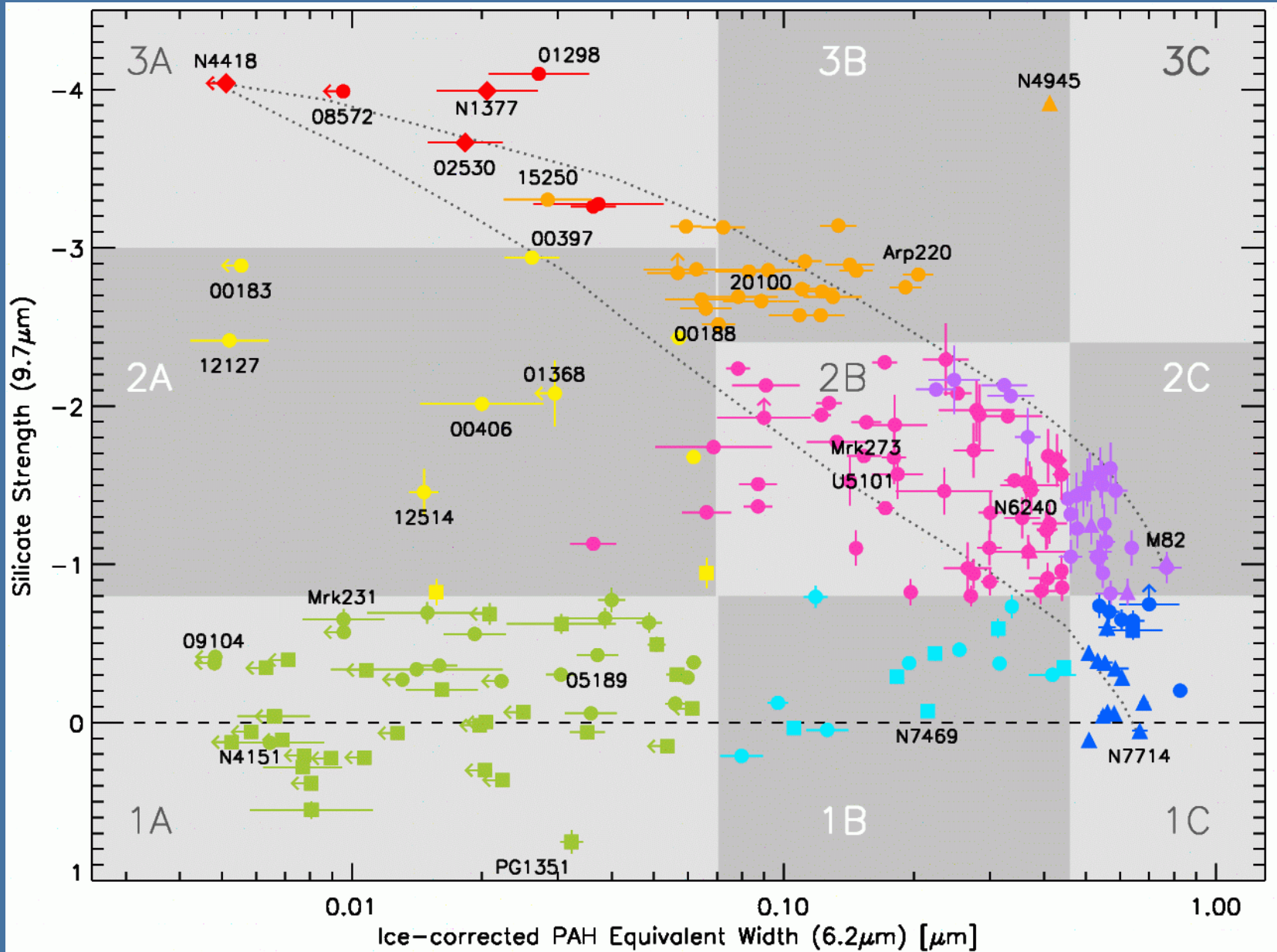
15-20 μm range fit

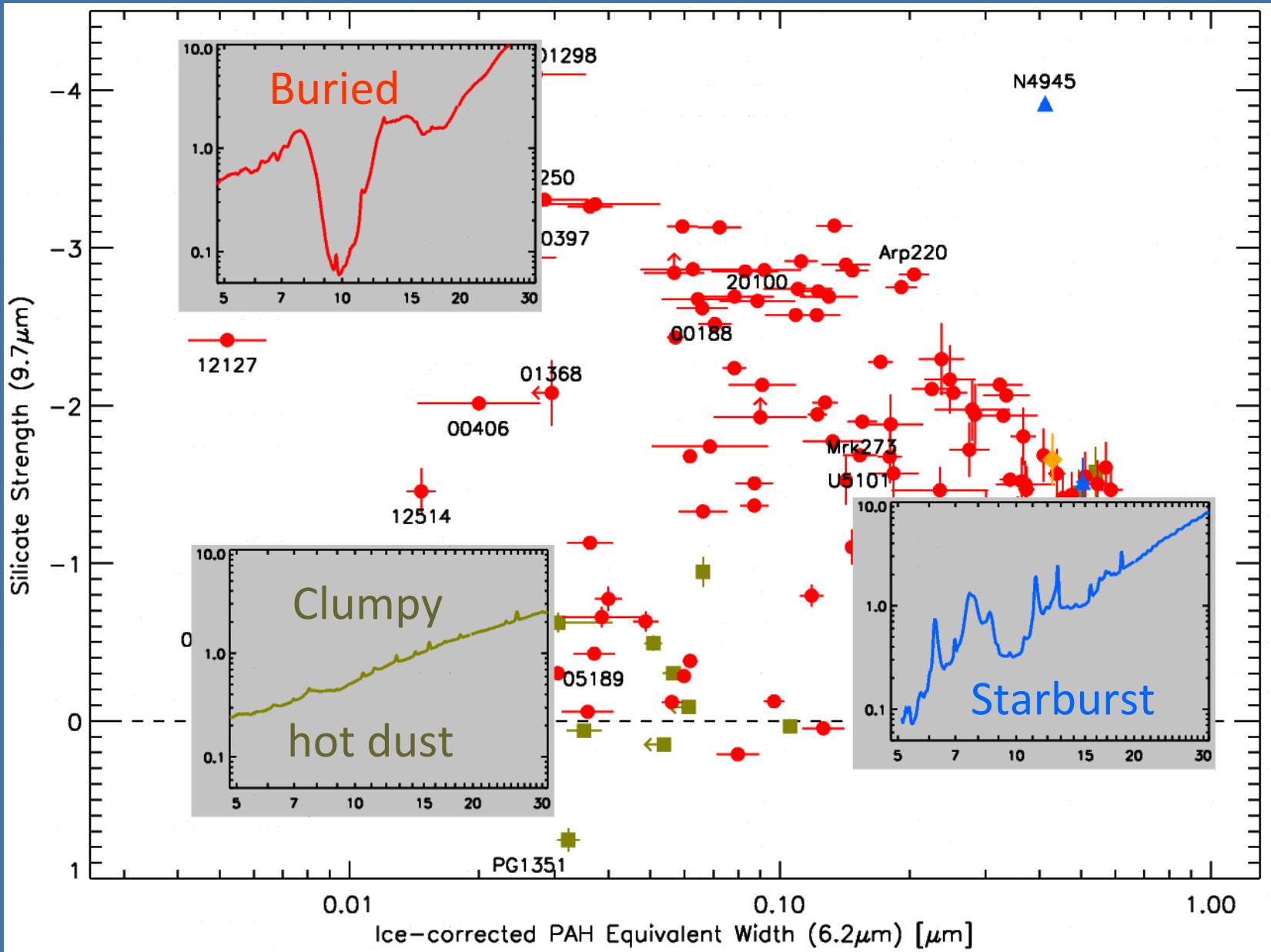


20-36 μm range fit



Mid-IR spectral classification



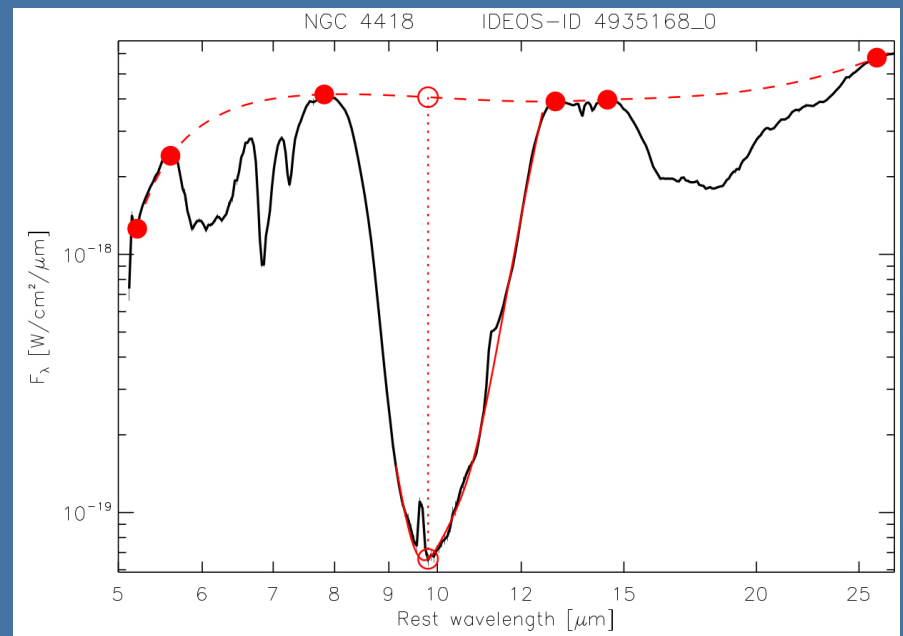
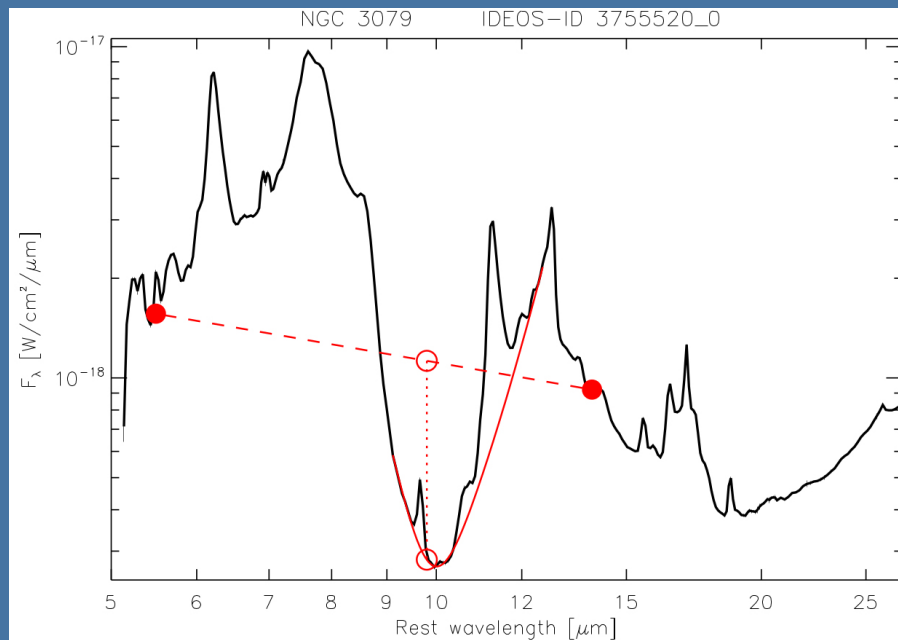
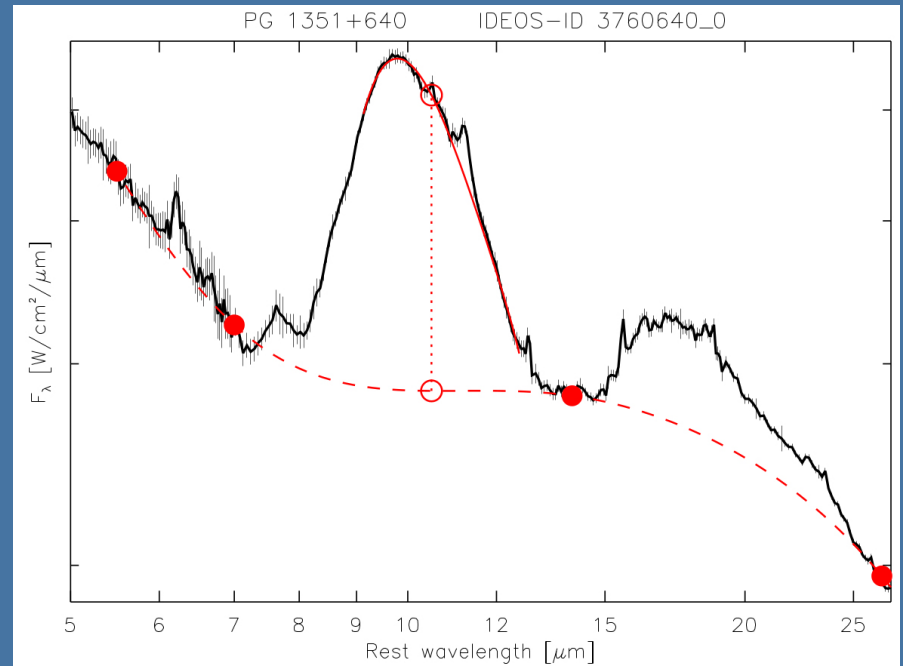


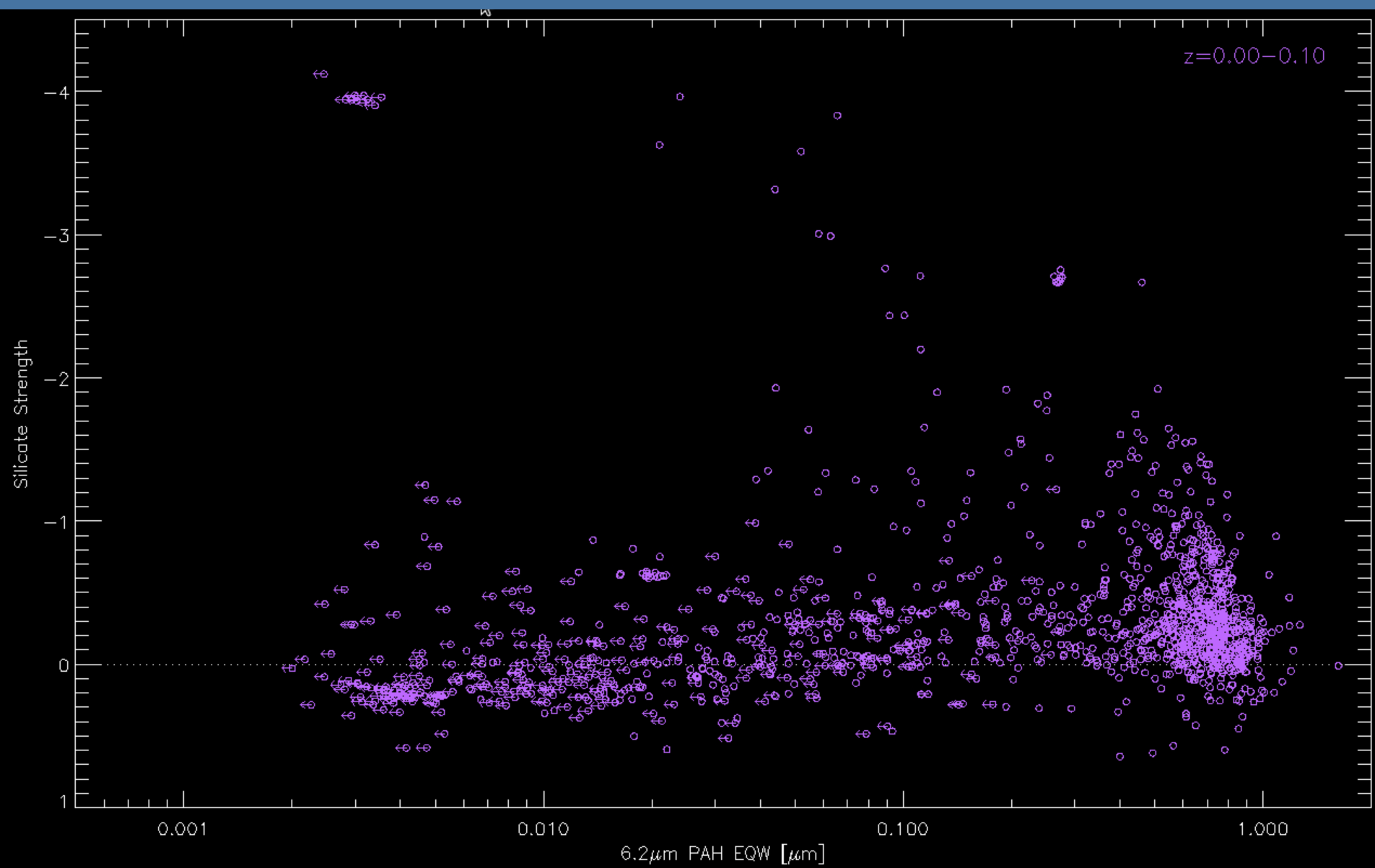
Determining Silicate Strength S_{sil} :

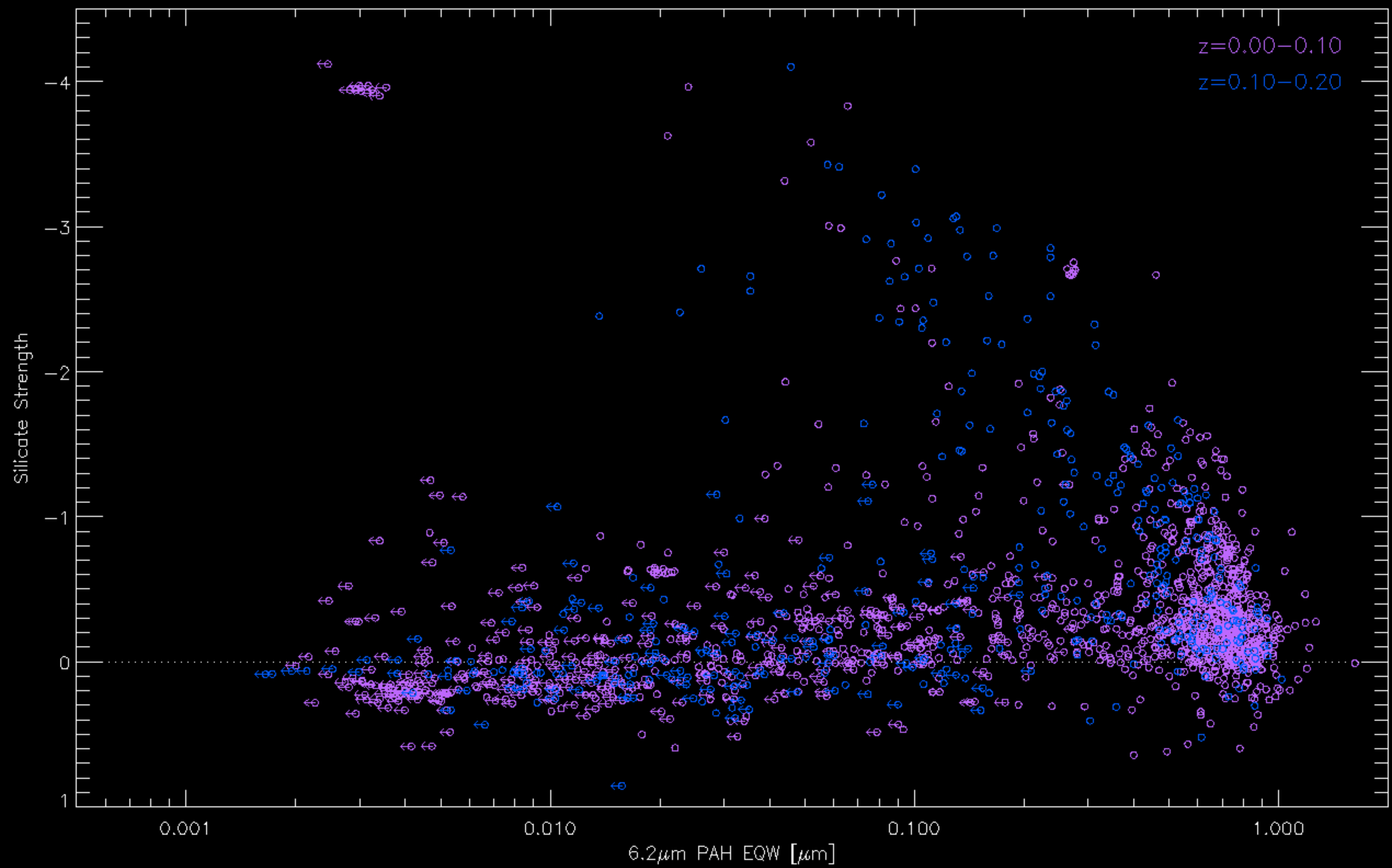
$$S_{\text{sil}} = \text{LN} \left[\frac{\text{Cont}_{\text{local}}}{\text{Cont}_{\text{interpolated}}} \right]$$

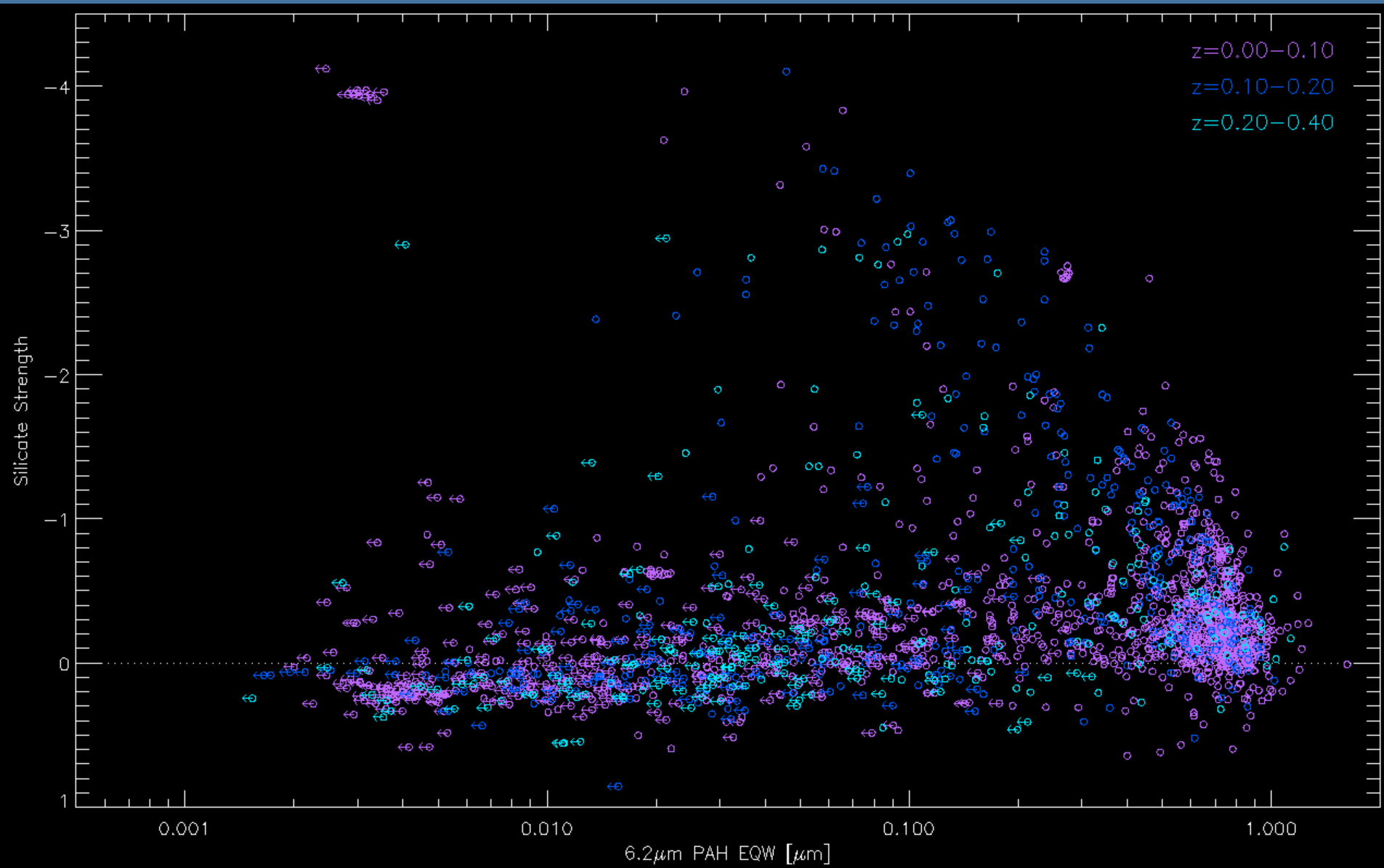
at $9.8\mu\text{m}$ or $10.5\mu\text{m}$

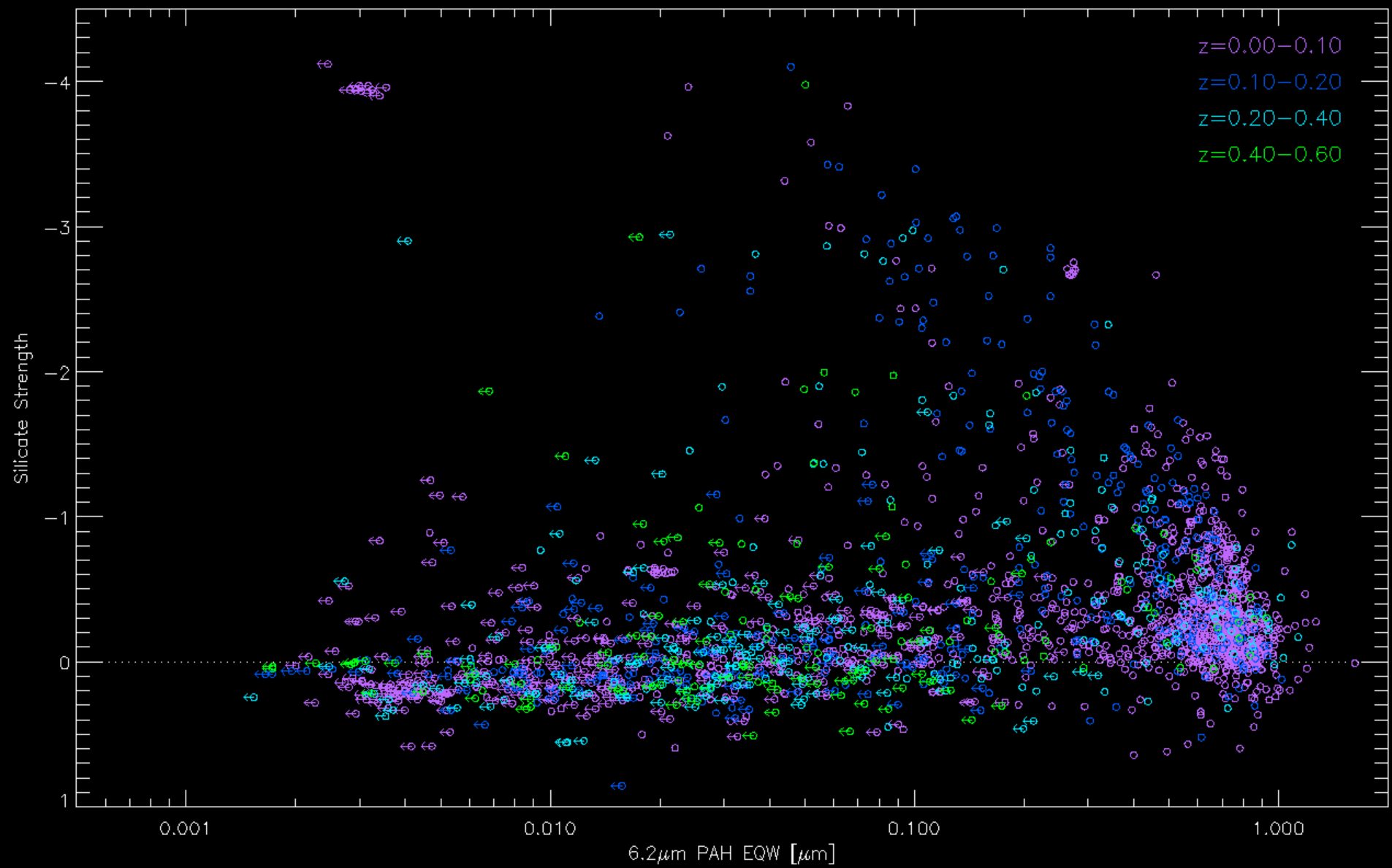
- fit the local observed continuum
- interpolate over the local continuum:
 - power-law interpolation
 - spline interpolation

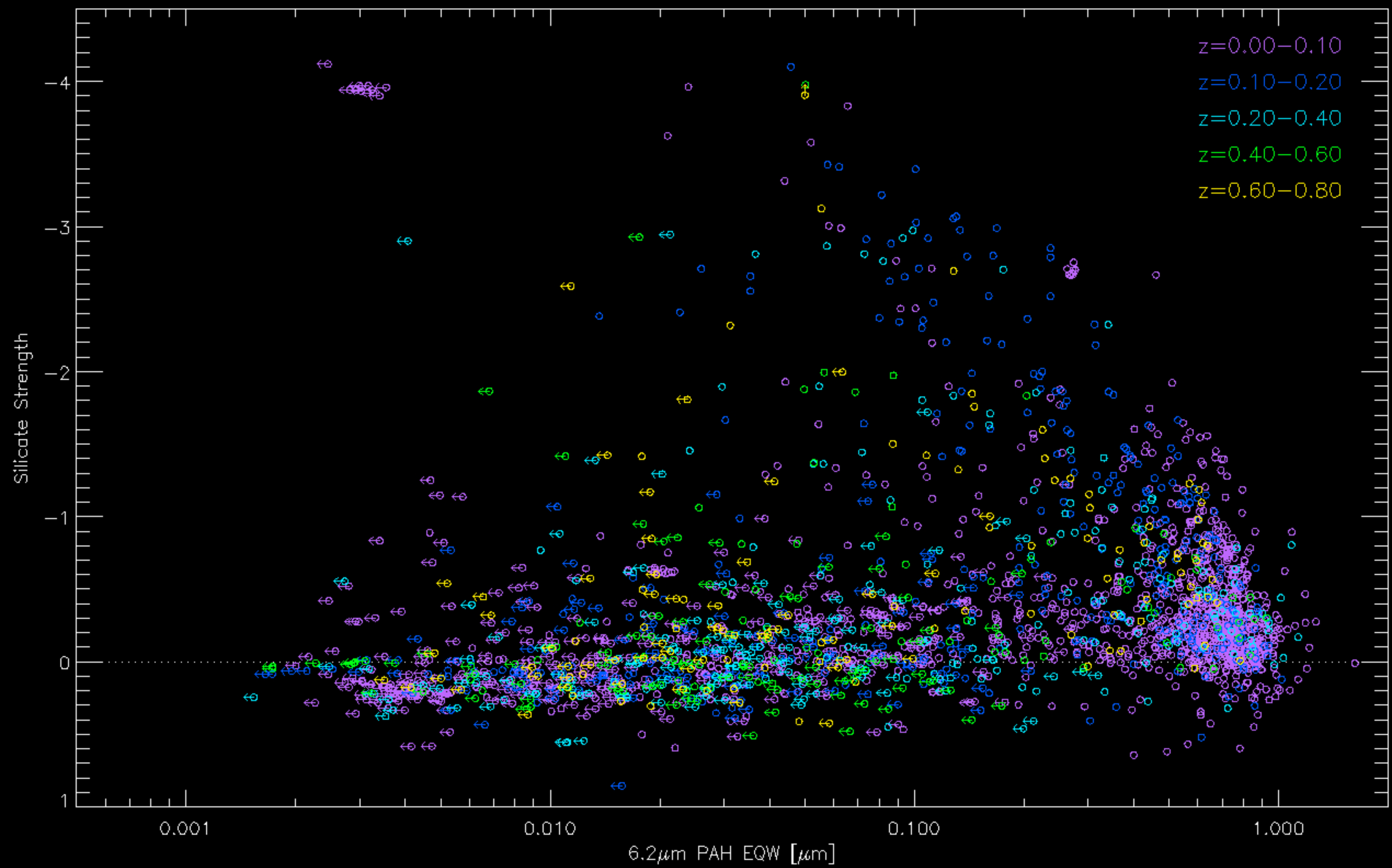


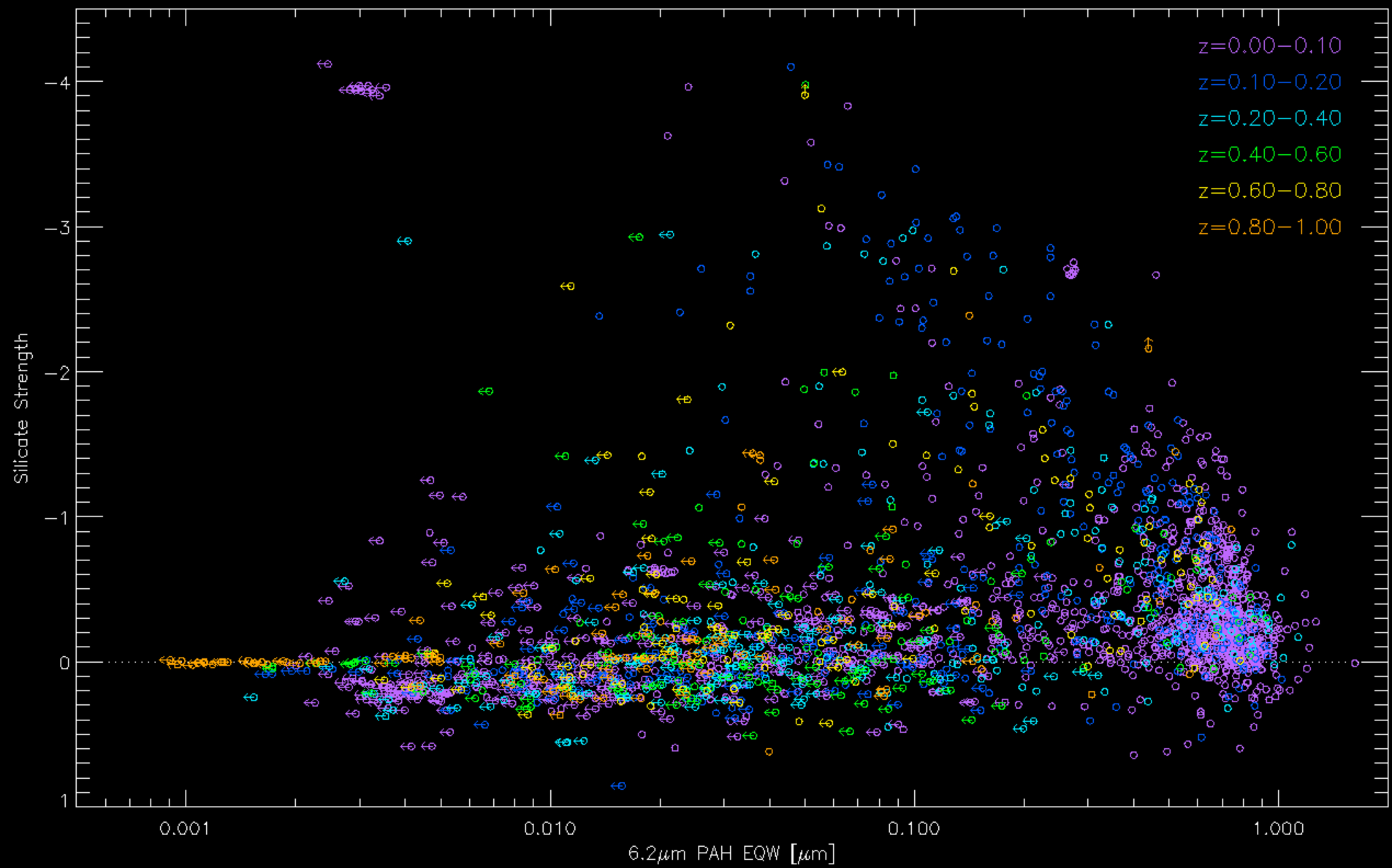


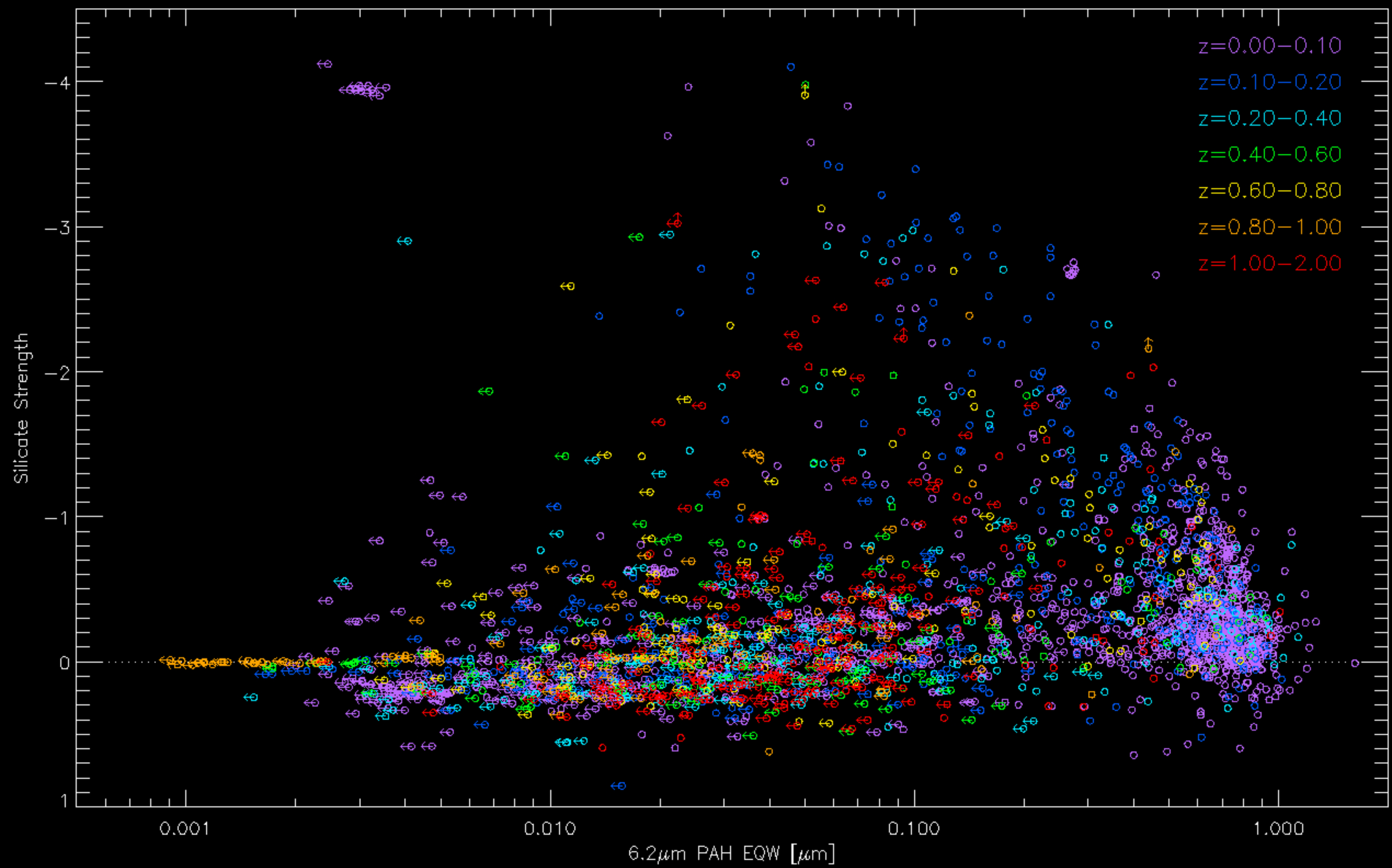




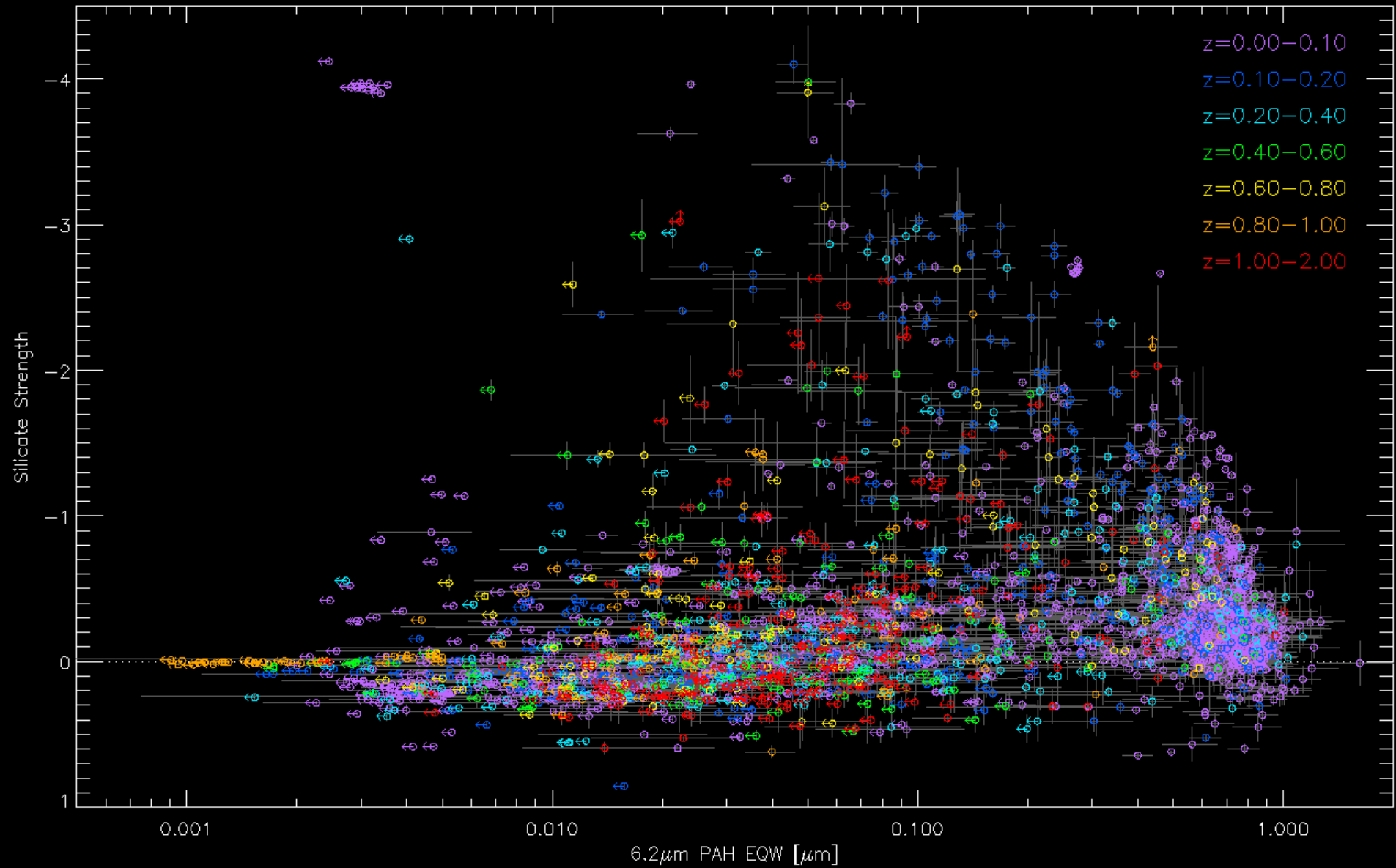




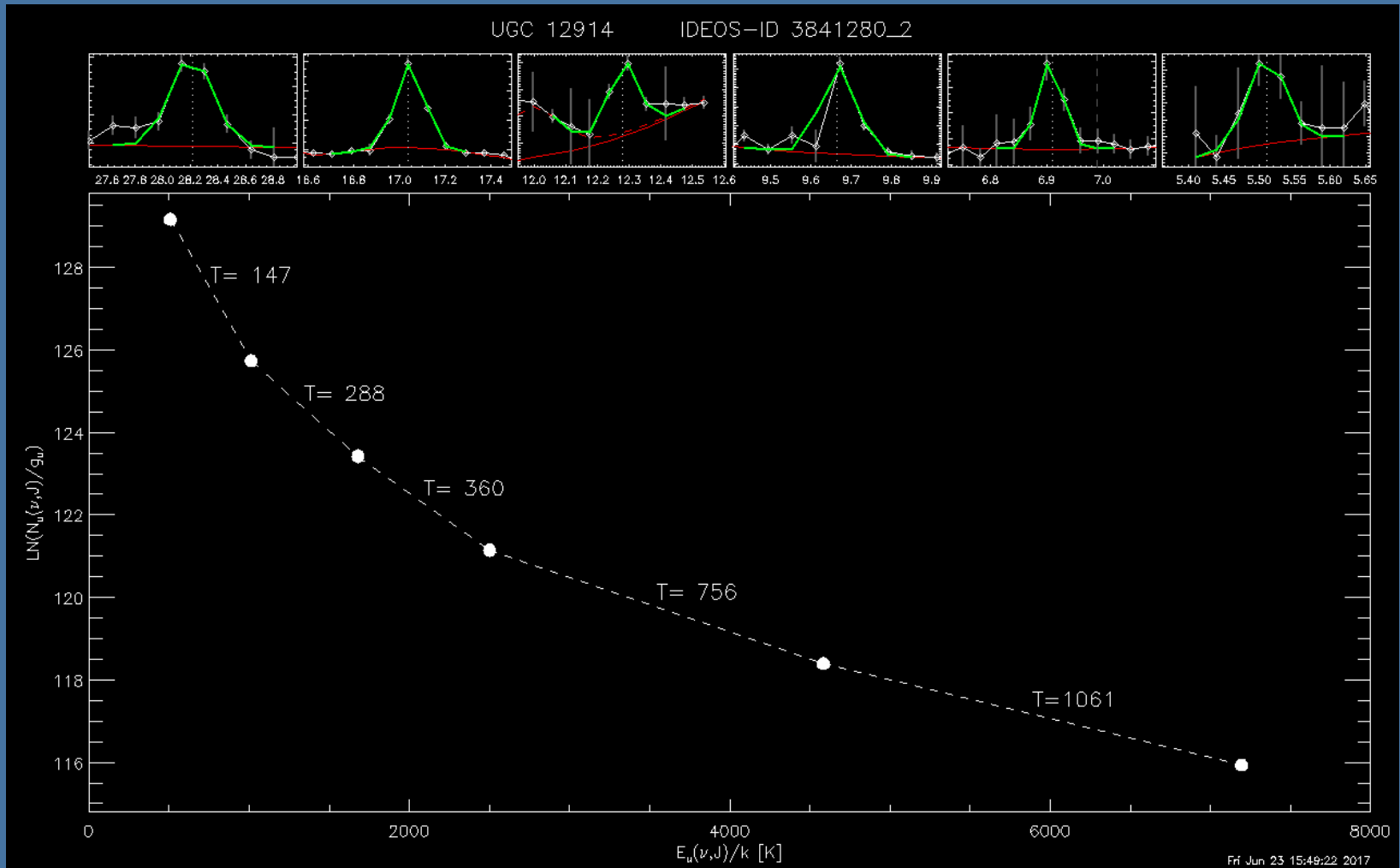




2158 IDEOS galaxies

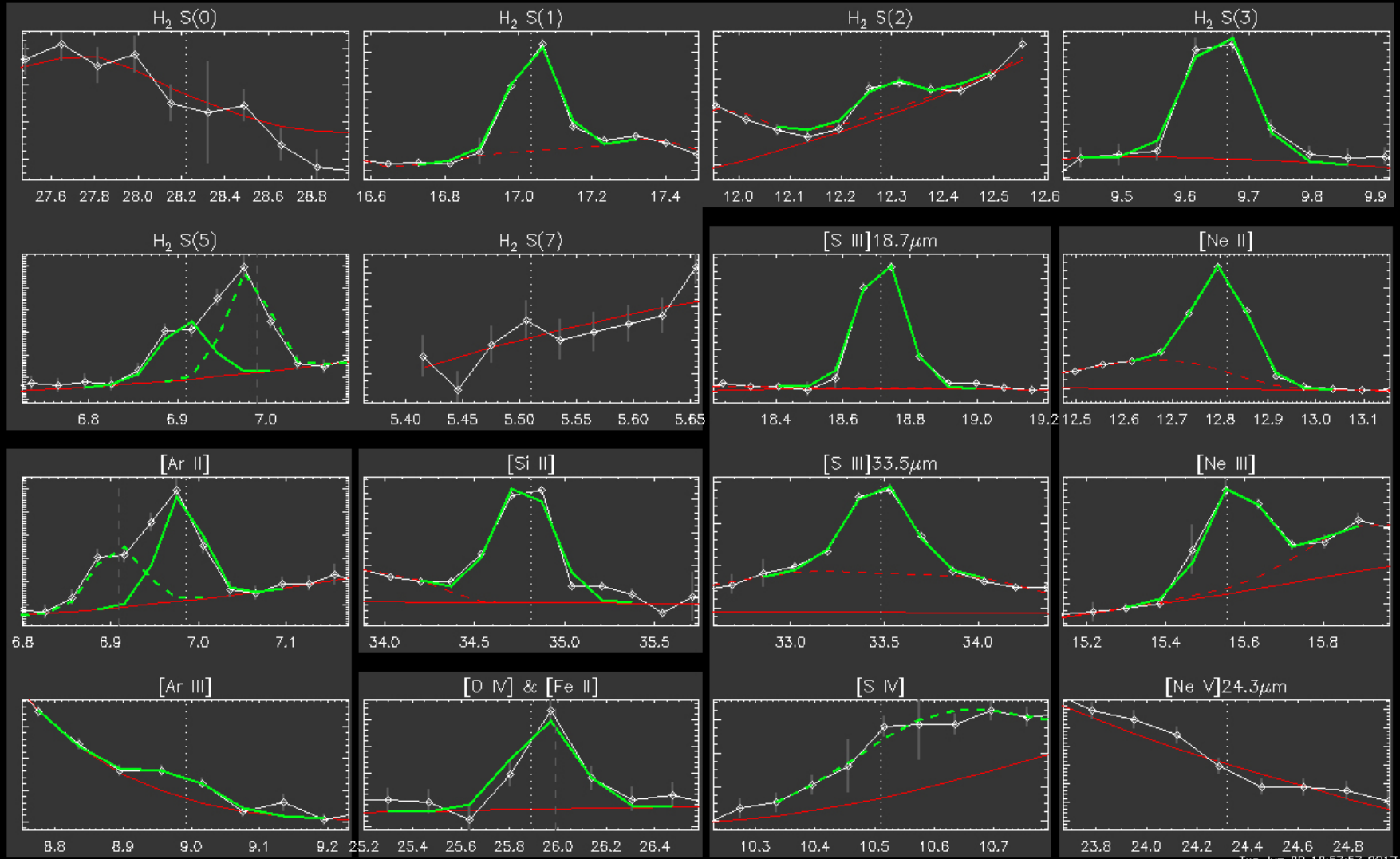


H₂ excitation diagram

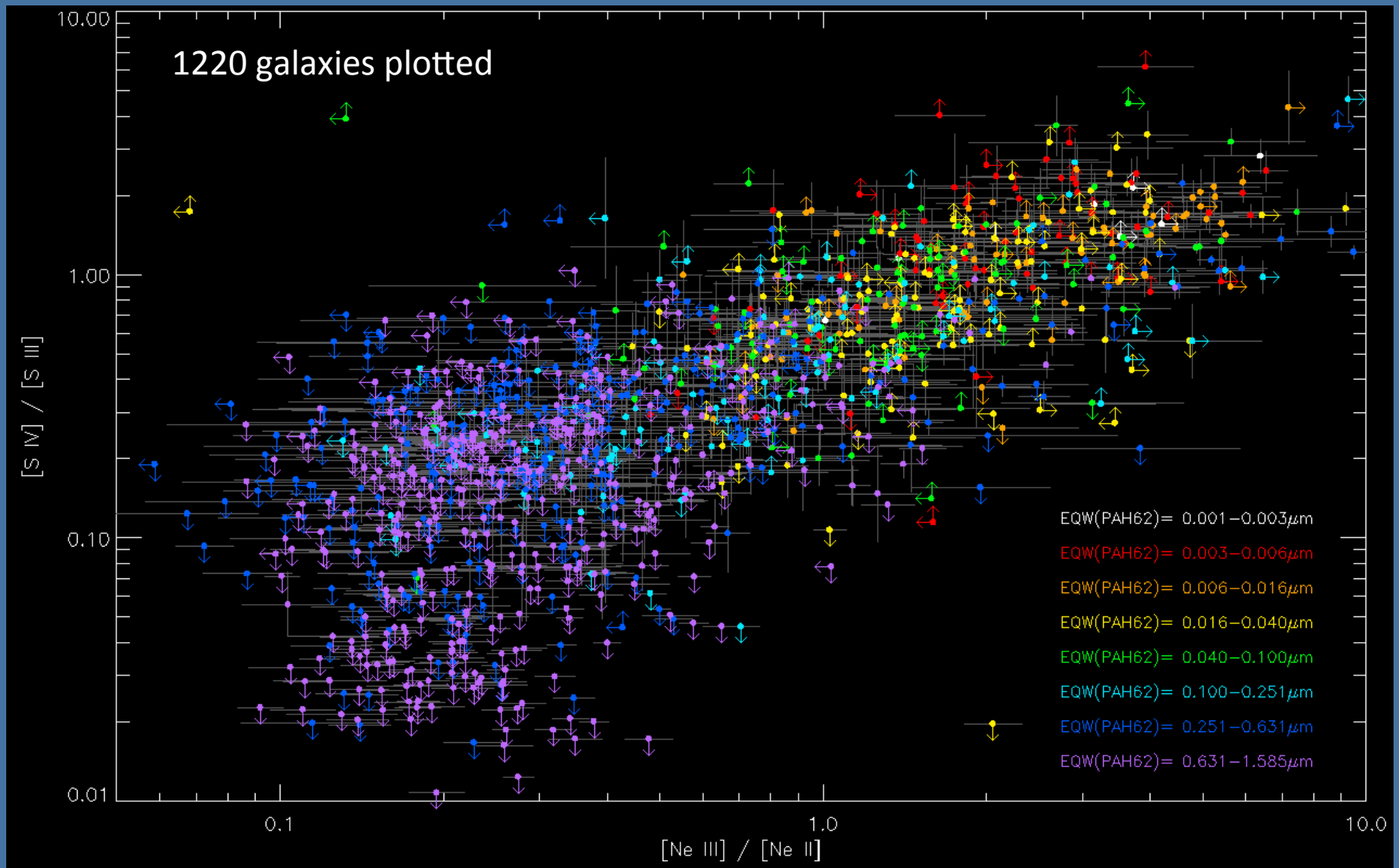


NGC 6764

IDEOS-ID 3858176_0



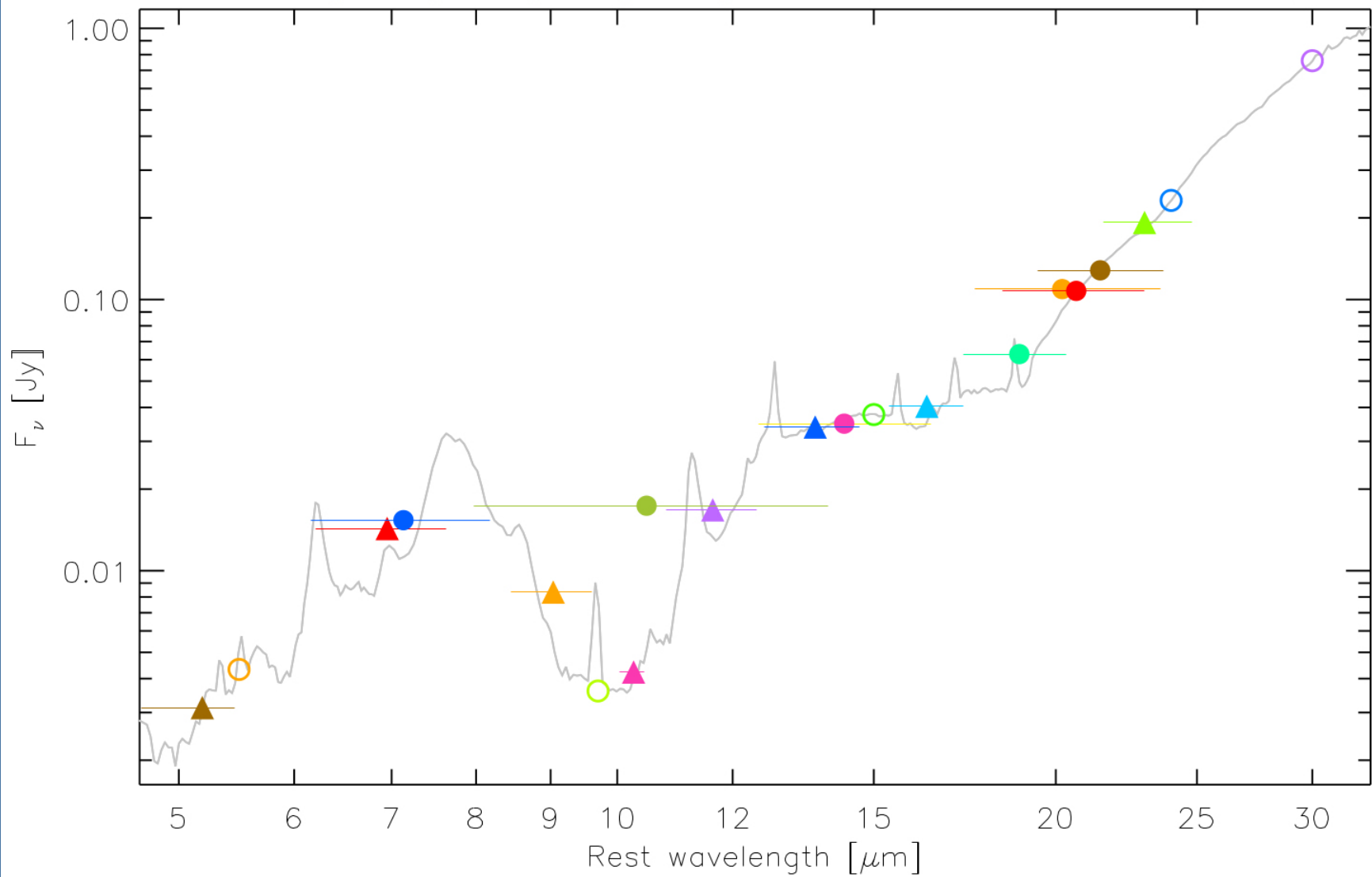
Diagnostic line ratios



SBS 1648+547

IDEOS-ID 10107392_0

▲ MIRI-5.6 ▲ MIRI-7.7 ▲ MIRI-10 ▲ MIRI-11 ▲ MIRI-13 ▲ MIRI-15 ▲ MIRI-18 ▲ MIRI-21 ▲ MIRI-25
○ REST55 ○ REST97 ○ REST15 ○ REST24 ○ REST30 ● IRAC8 ● WISE12 ● IRS15 ● IRS22 ● WISE22 ● MIPS24

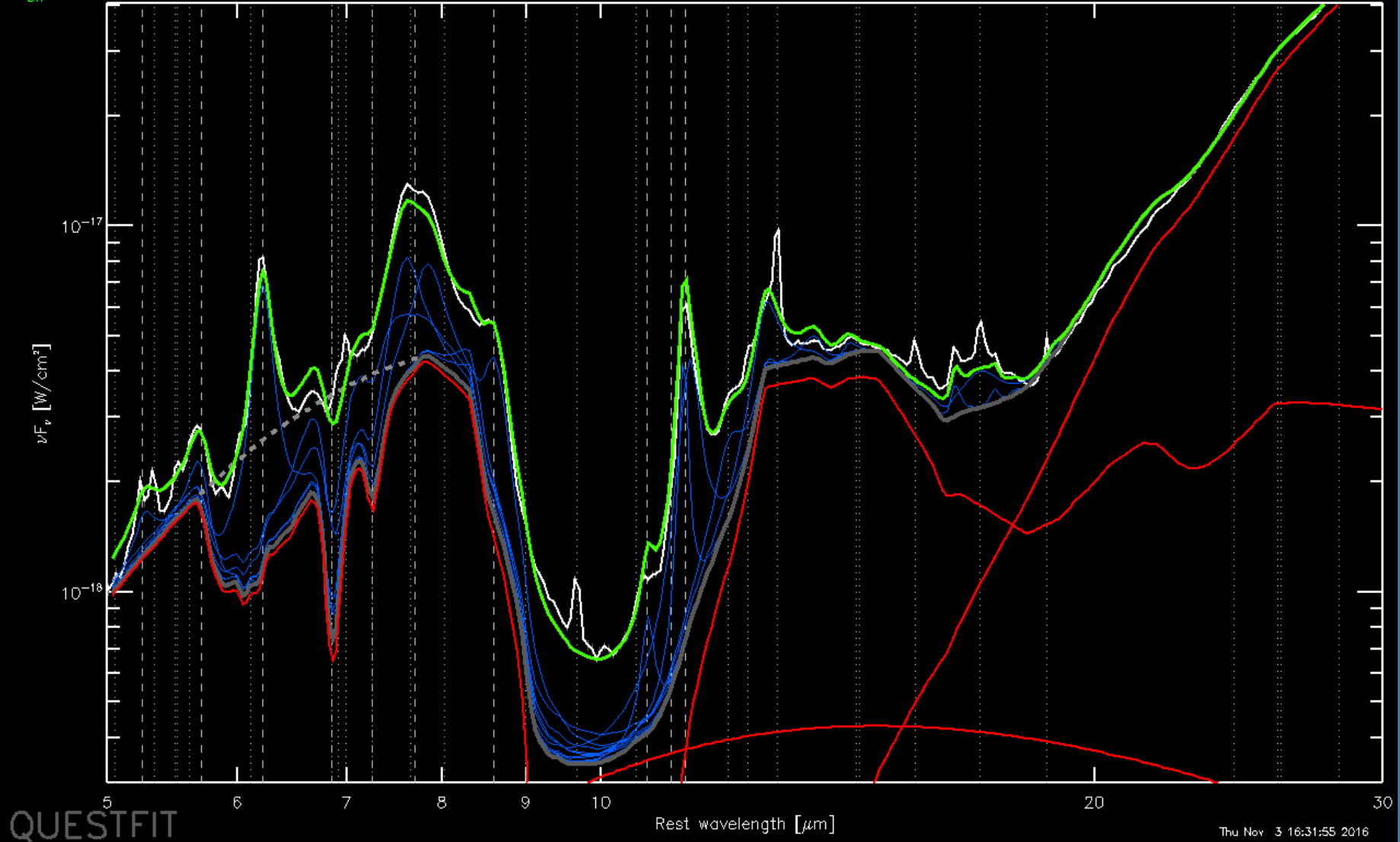


PAHFIT and QUESTFIT spectral decomposition

$S_{\text{sil}} = -5.39$

2MASX J17232194-0017009

IDEOS-ID 4986624_0



QUESTFIT: Veilleux+09

PAHFIT: Smith+07

Crystallinity of Galactic ISM is low:

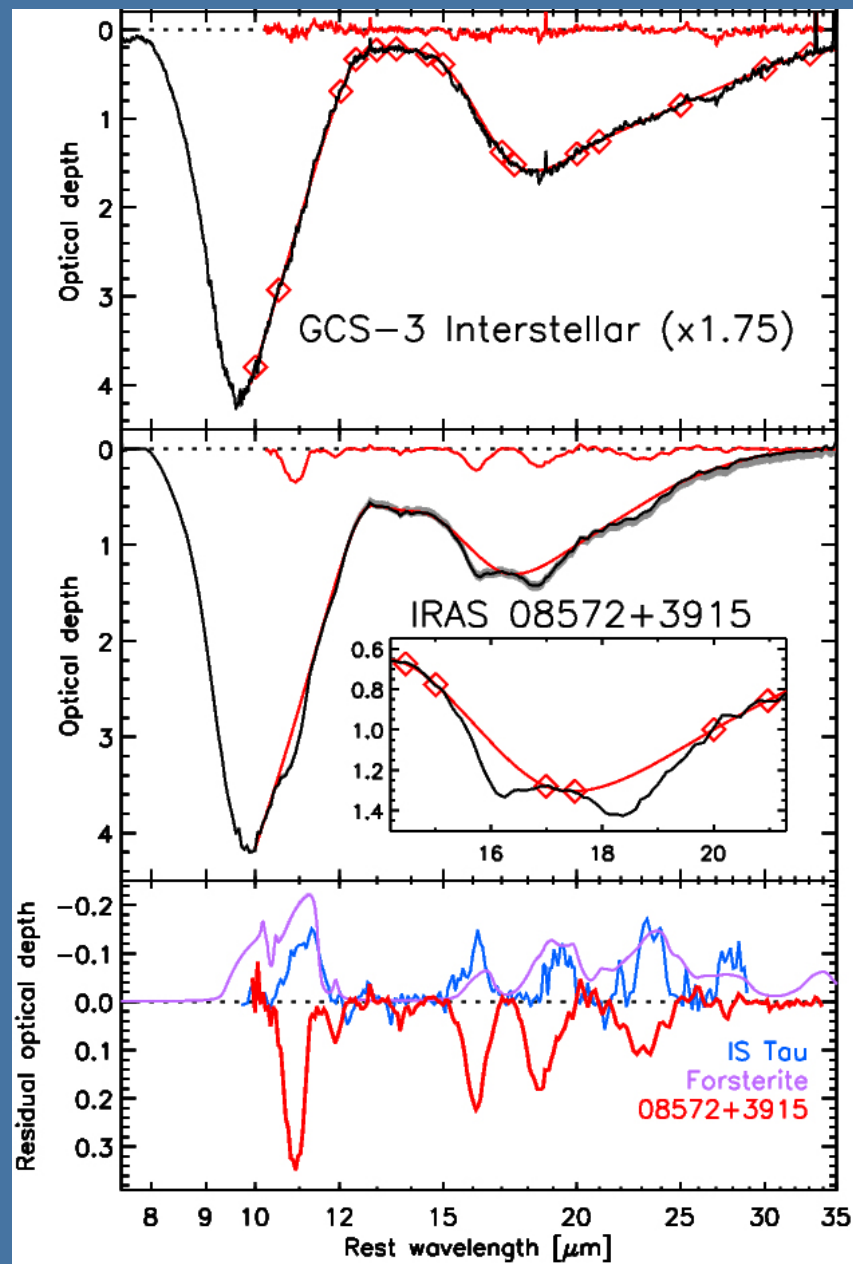
$$N_{\text{cryst}} / (N_{\text{cryst}} + N_{\text{amor}}) < 1\% \quad (\text{Kemper+04})$$

Crystallinity in ULIRG sample:

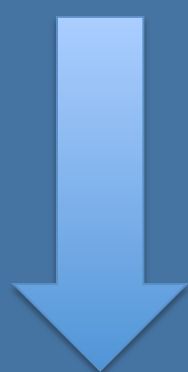
7-14% (Spoon+06)

IDEOS sample:

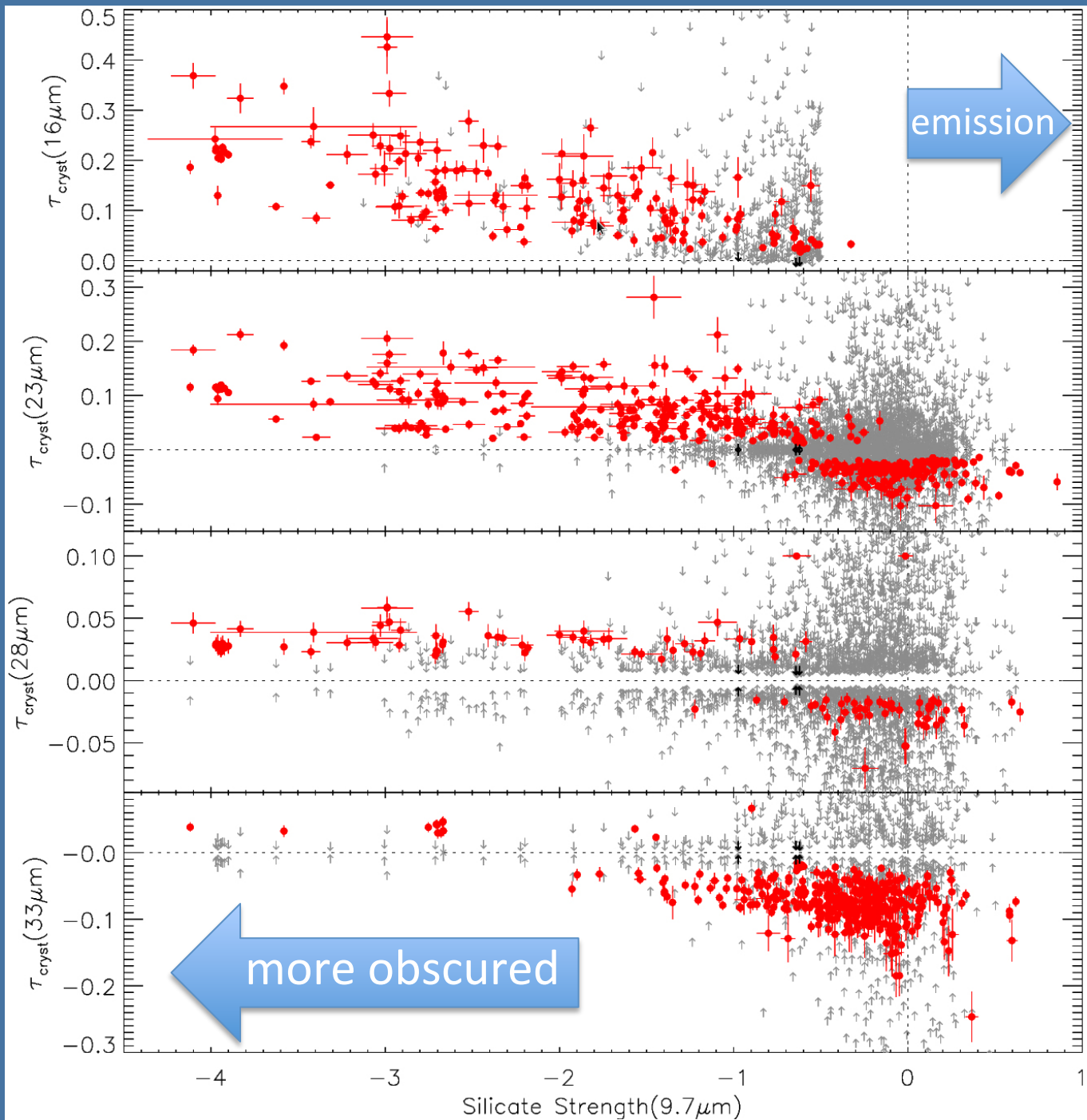
- we detected crystalline silicates in 844/3500 spectra
- strict non-detections in only 3/3500 spectra !



CRYST
absorption



CRYST
emission



emission

CRYST
16 μm

CRYST
23 μm

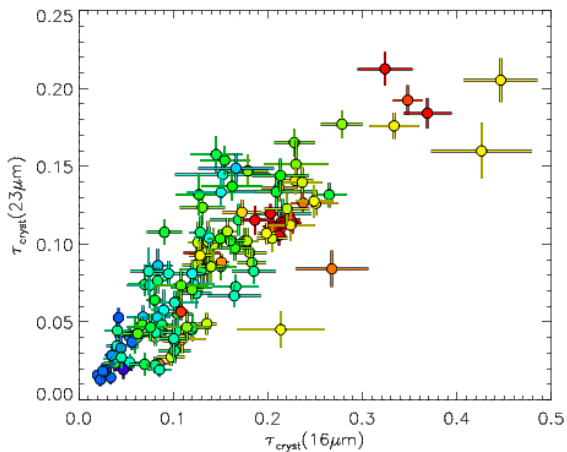
CRYST
28 μm

CRYST
33 μm

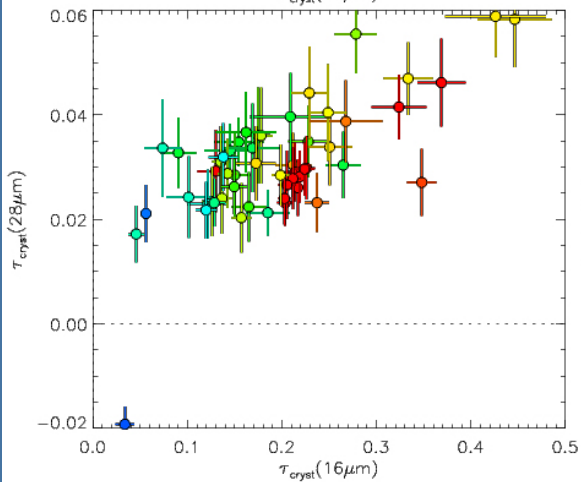
more obscured

Silicate Strength(9.7 μm)

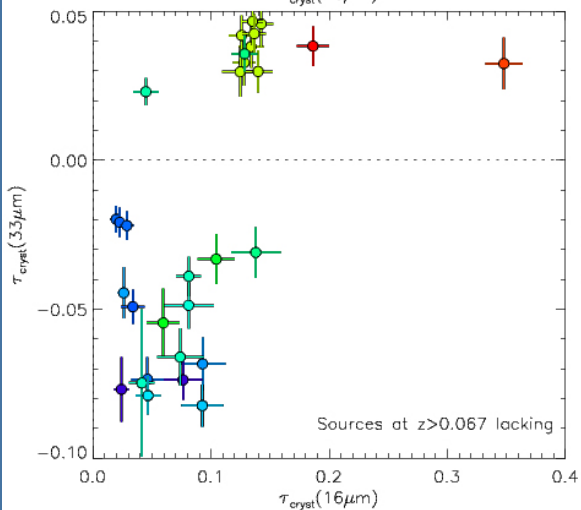
CRYST
16 & 23



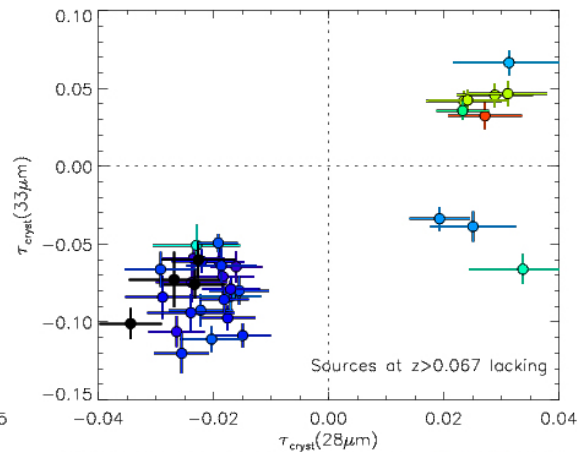
CRYST
16 & 28



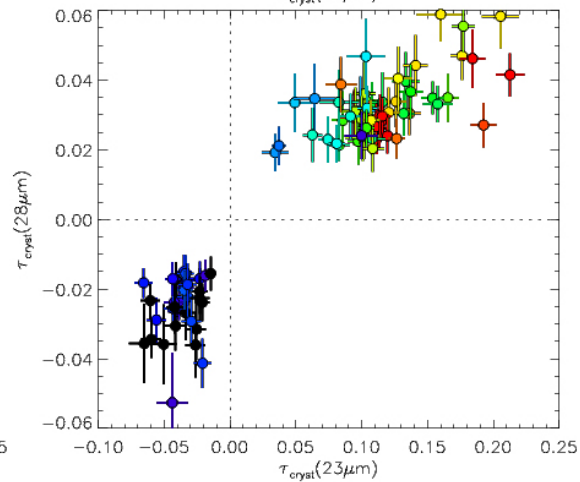
CRYST
16 & 33



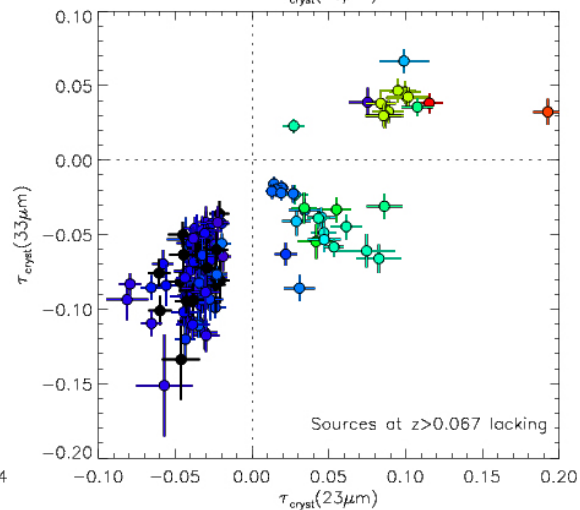
CRYST
28 & 33



CRYST
23 & 28



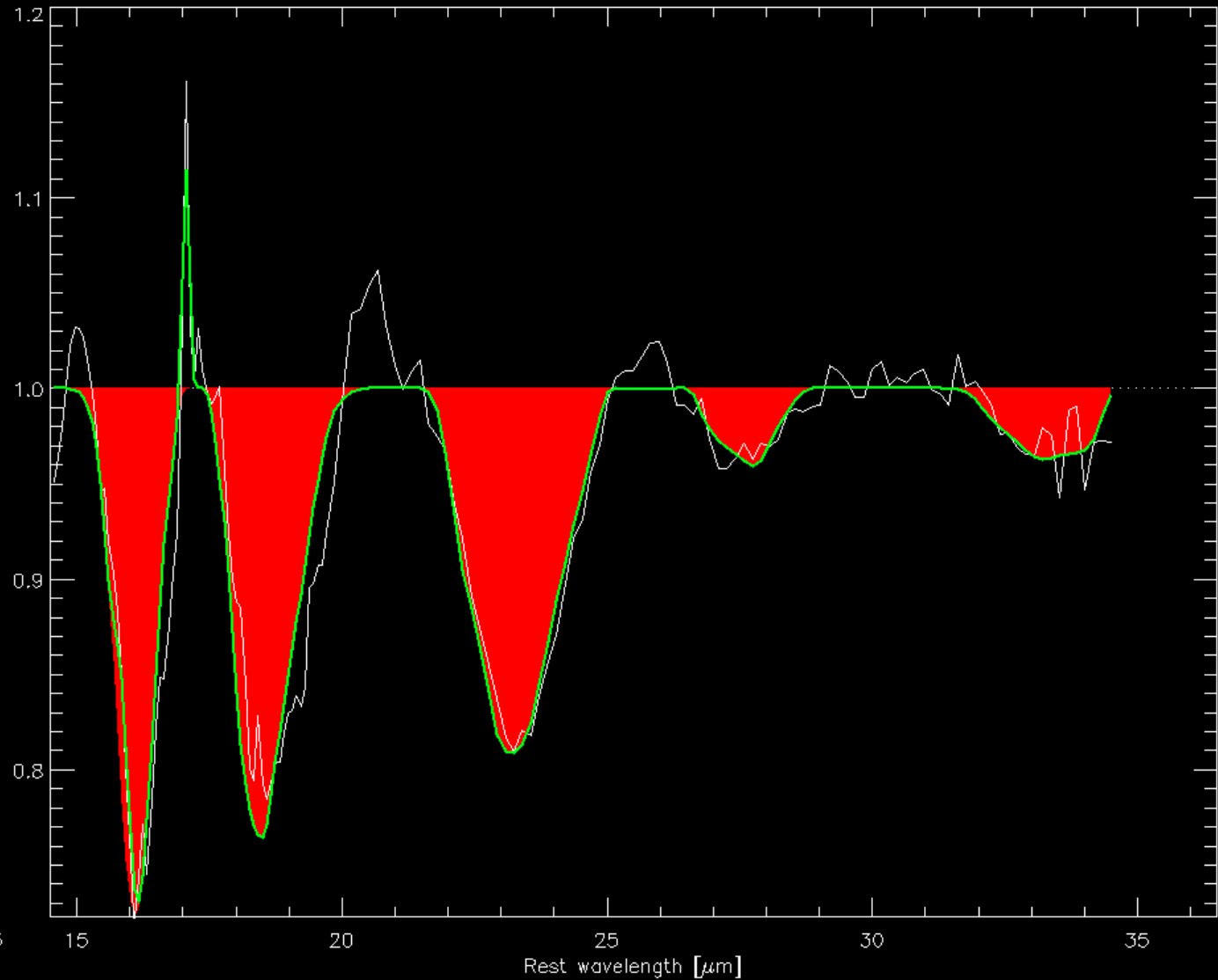
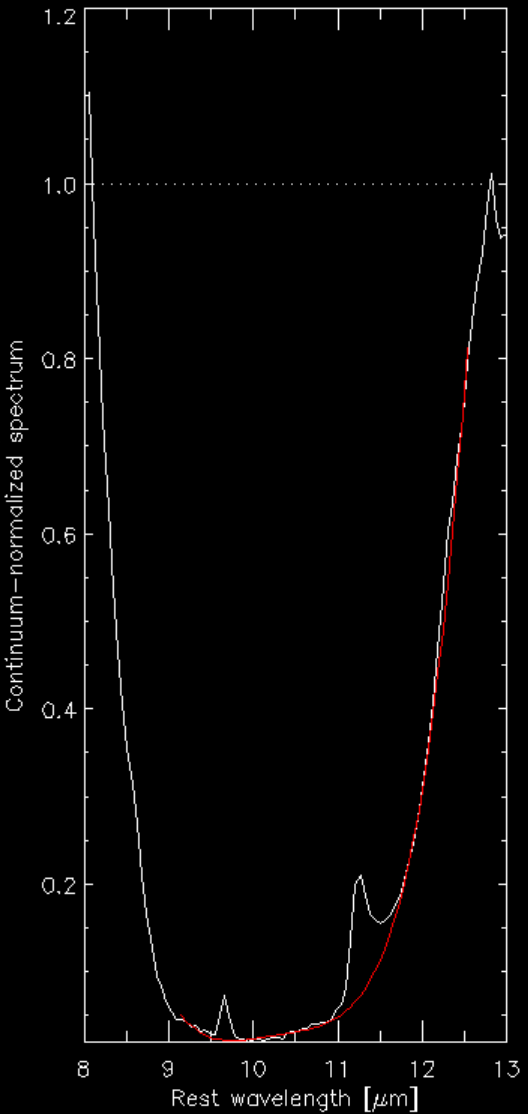
CRYST
23 & 33



$S_{\text{sil}} = -3.83$

2MASX J04464950-4833303

IDEOS-ID 20334080_D



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IDEOS

ideos.astro.cornell.edu

to become available soon: ask for a demo!

paper I: Hernán-Caballero+16 (redshifts)

paper II: to be submitted end of summer'17 (database)