The Infrared Database of Extragalactic Observables from Spitzer

IDEOS

IDEOS collaborators:

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Observables for 3500 IRS low-resolution galaxy spectra:

- Line fluxes for 18 lines
- Fluxes and equivalent widths for 14 PAH bands
- 9.7µm silicate strength
- Crystalline silicate strengths for 4 bands
- 6µm water ice; 6.85µm 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: $z_{\text{NED}}$ or $z_{\text{IRS}}$.
  
  (124 galaxies had wrong $z_{\text{NED}}$. 228 got their first redshift: $z_{\text{IRS}}$)
- 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 5.4-7.2μm range
8.6-10μm range
9.8-13.5μm range fit
15-20μm range fit
20-36μm range fit
Mid-IR spectral classification

Spoon+07
Determining Silicate Strength $S_{\text{sil}}$:

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

at 9.8μm or 10.5μm

- fit the local observed continuum

- interpolate over the local continuum:
  - power-law interpolation
  - spline interpolation
$H_2$ excitation diagram
Diagnos?c line ratios

1220 galaxies plotted

[Image of a scatter plot showing diagnostic line ratios with 1220 galaxies plotted.]
PAHFIT and QUESTFIT spectral decomposition

$S_{sil} = -5.39$

QUESTFIT: Veilleux+09

PAHFIT: Smith+07
Crystallinity of Galactic ISM is low:

\[ \frac{N_{\text{cryst}}}{N_{\text{cryst}} + N_{\text{amor}}} < 1\% \] (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 emission

more obscured

emission

CRUST 16μm

CRUST 23μm

CRUST 28μm

CRUST 33μm
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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)