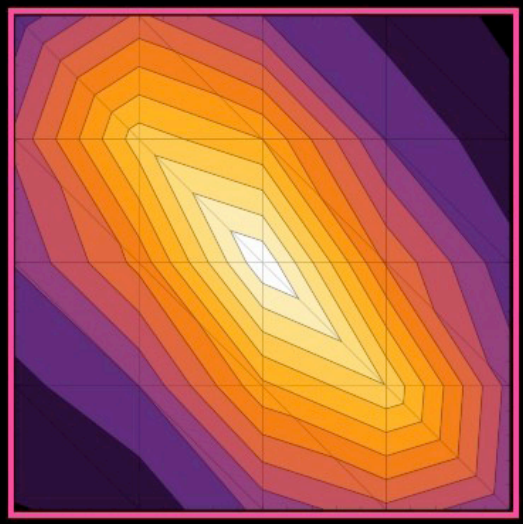
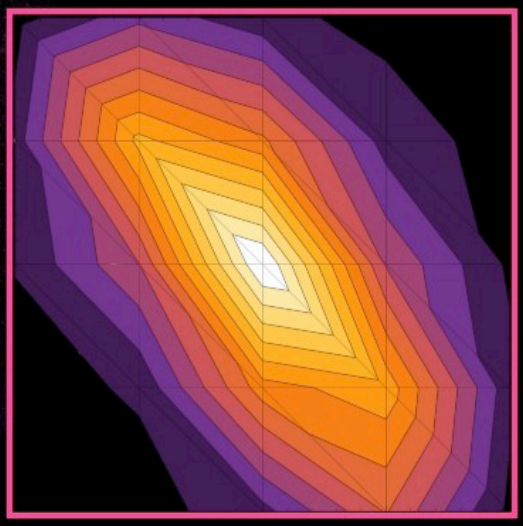
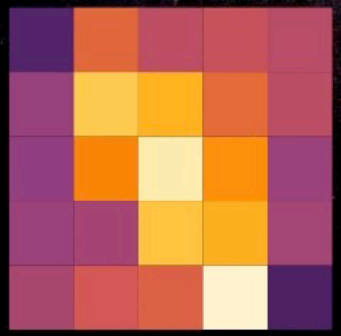
First Results from SHINING

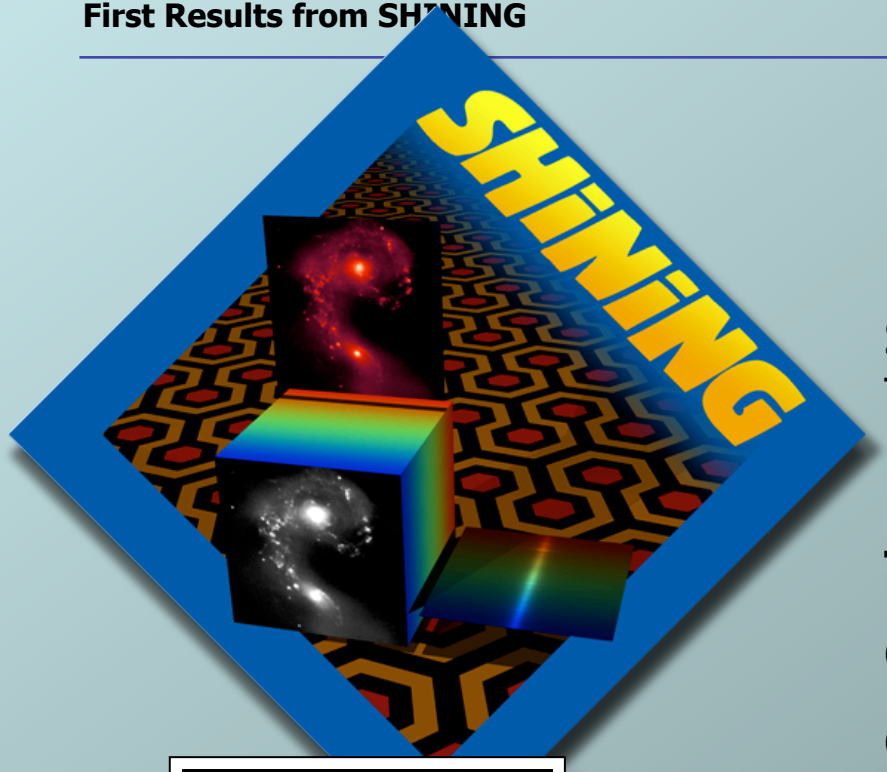


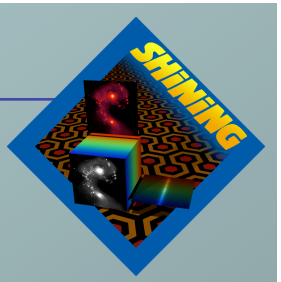
E. Sturm, for the SHINING consortium





SHINING = **S**urvey with **H**erschel of the **I**SM in **N**earby **IN**frared **G**alaxies





MPE: E. Sturm (PI), A. Contursi, R. Genzel, J. Gracia Carpio, S. Hailey-Dunsheath, D. Lutz, A. Poglitsch, L. Tacconi, J. DeJong

NRL/MPE: J. Fischer

Tel Aviv: A. Sternberg

Oxford: A. Verma, N. Christopher

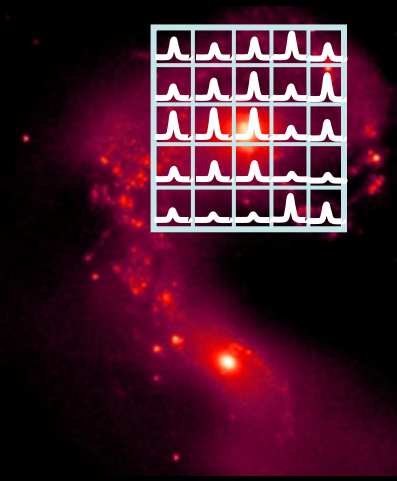
CEA/IAP: S. Madden (Co-PI), M. Sauvage, L. Vigroux, Diane Cormier

MPIA: U. Klaas (Co-PI), M. Nielbock, H. Linz, J. Schreiber, O. Krause, D. Lemke, E. Schinnerer, F. Walter

BochumUniv: M. Haas

I) SHINING Goals

The **physical processes** in the **interstellar medium of local, infrared bright galaxies**

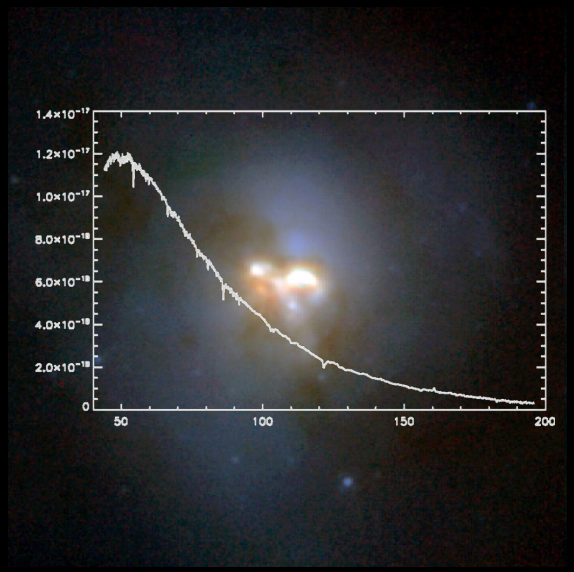


PACS (+ SPIRE) Photometry and Spectroscopy

Starbursts, AGN, ULIRGs

Interacting Galaxies

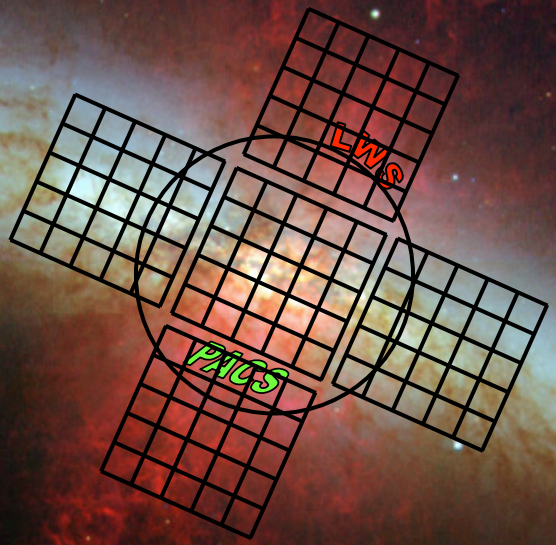
Dwarf Galaxies

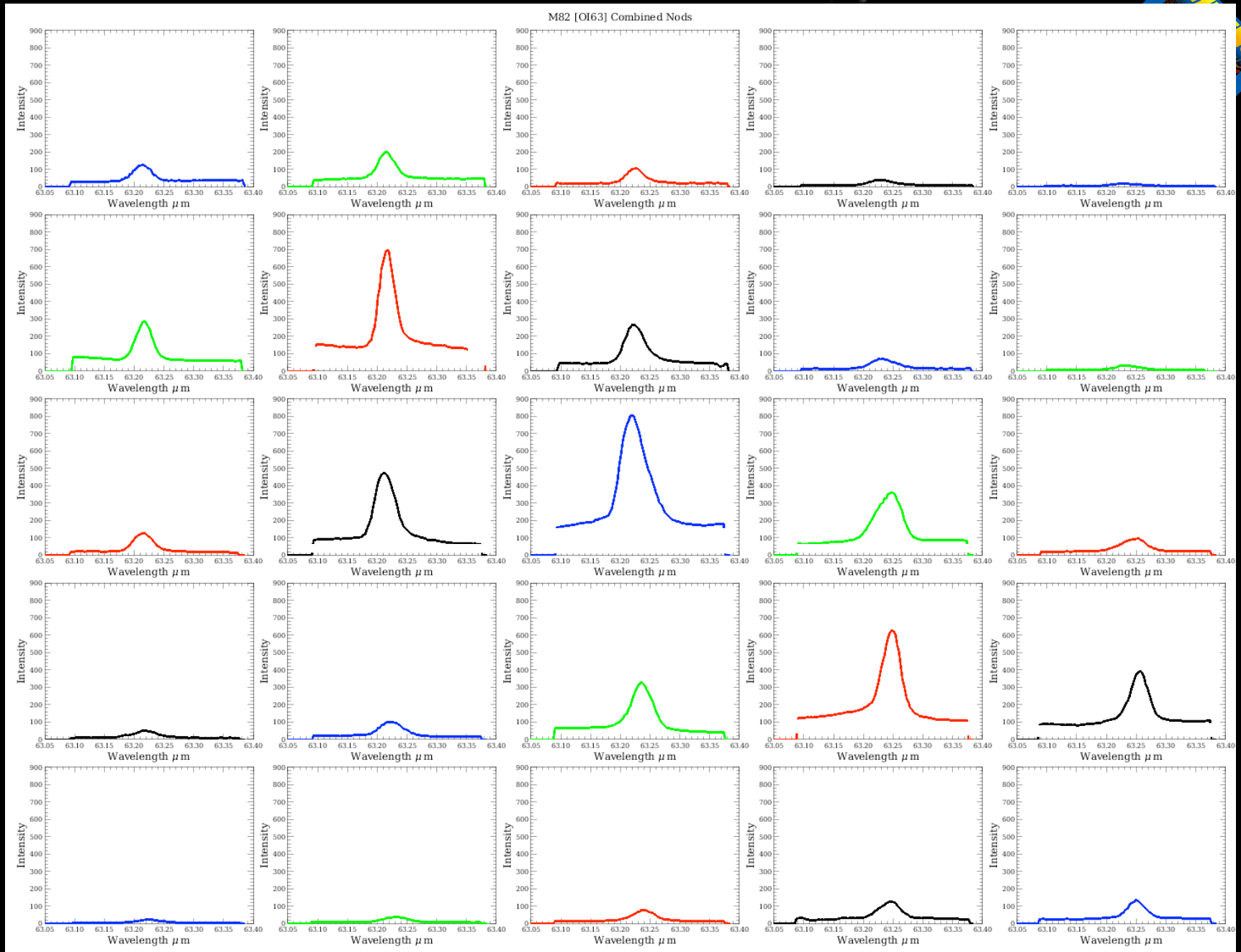


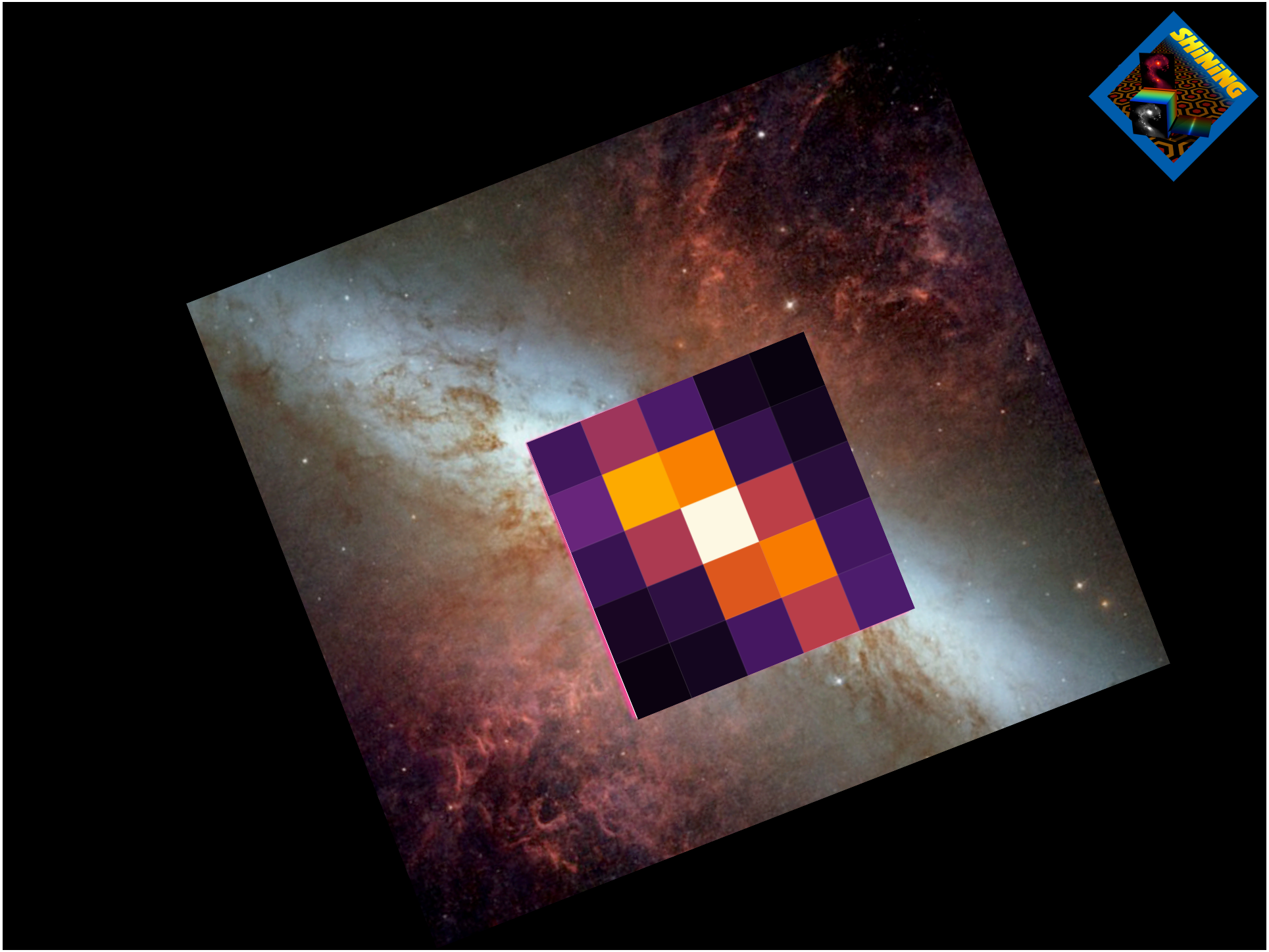
The objects cover a wide parameter range in
- **luminosity**,
- **activity level**, and
- **metal enrichment**,

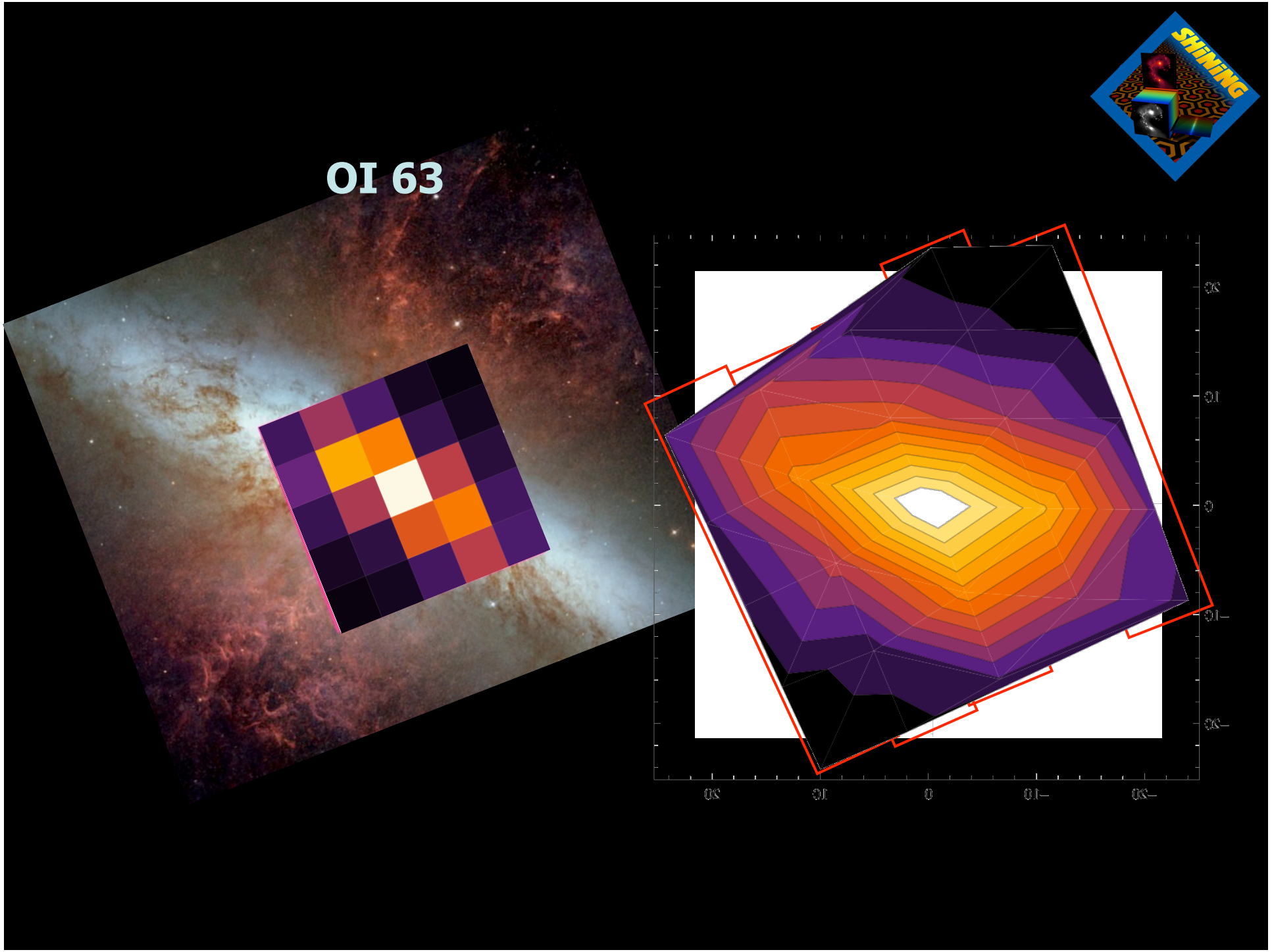
and will be complemented by a few objects at **intermediate redshifts**, i.e. at a more active epoch of star formation.

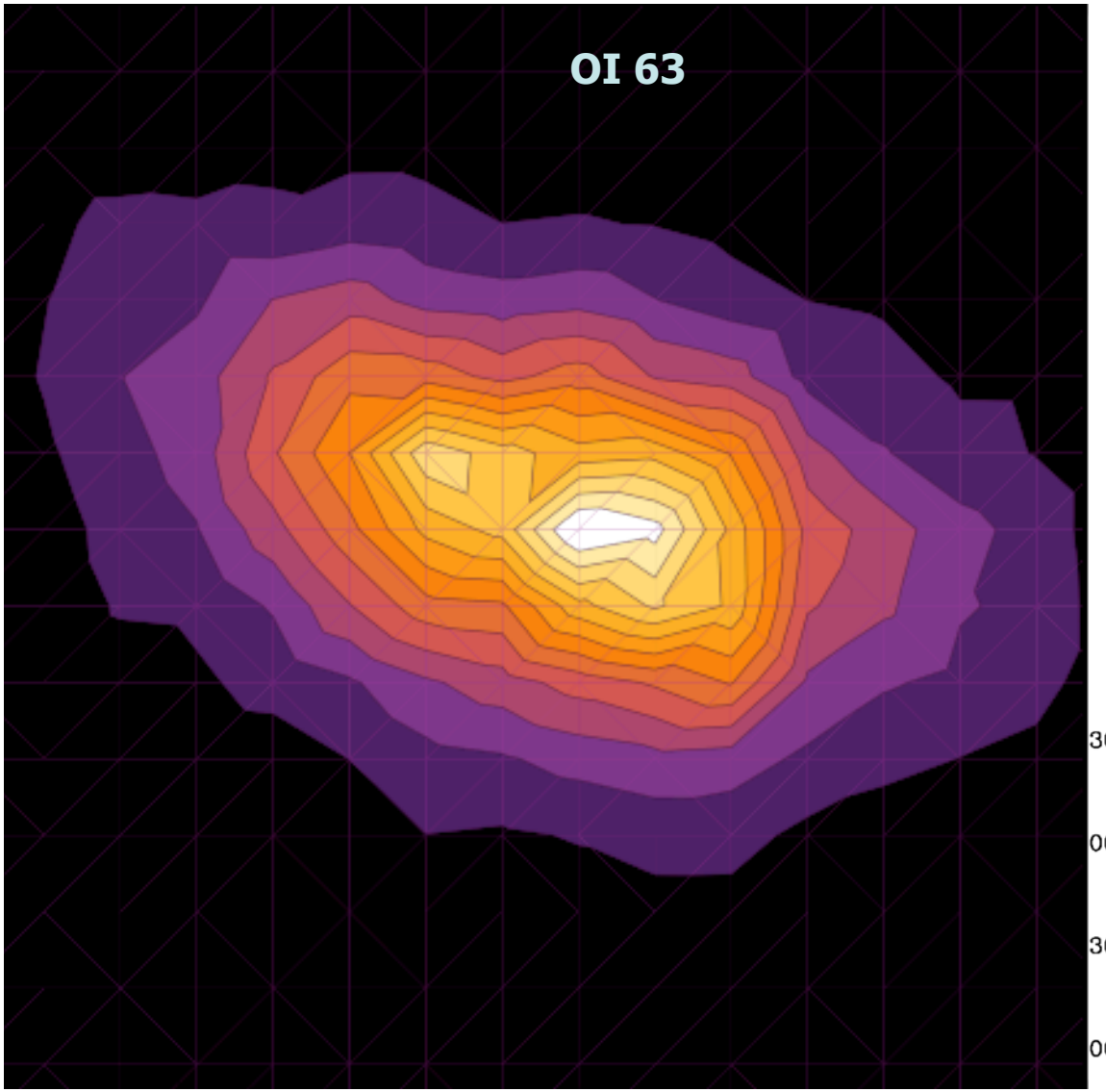
First Results from SDP
II) M82




M82 [OI63] Combined Nods
Intensity
Wavelength μm

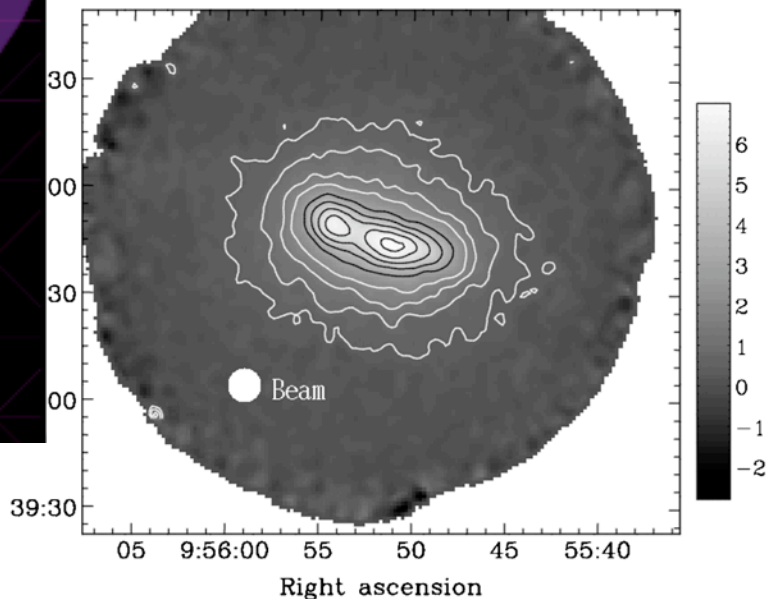

SHINING

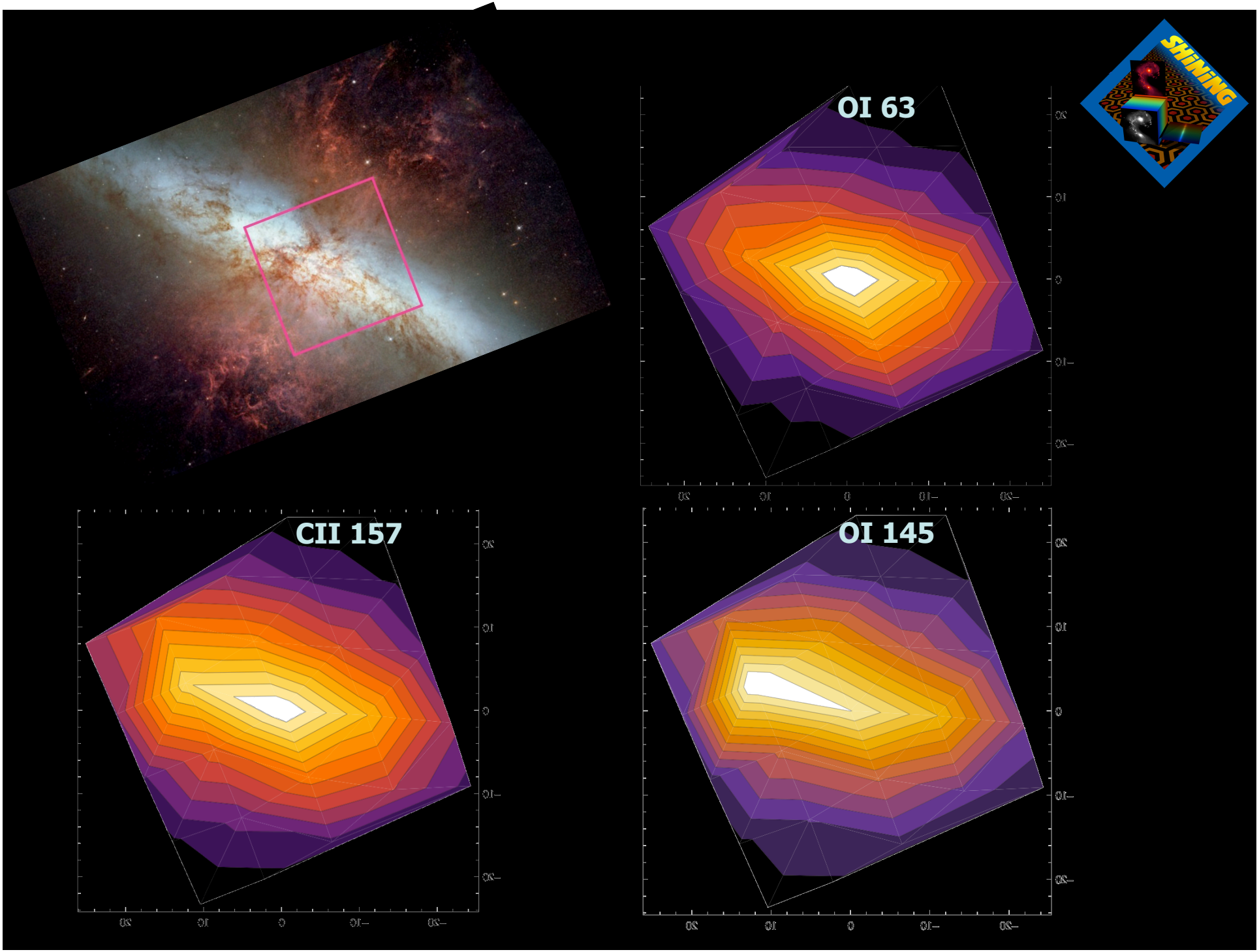

OI 63
SHINING
20
10
0
−10
−20

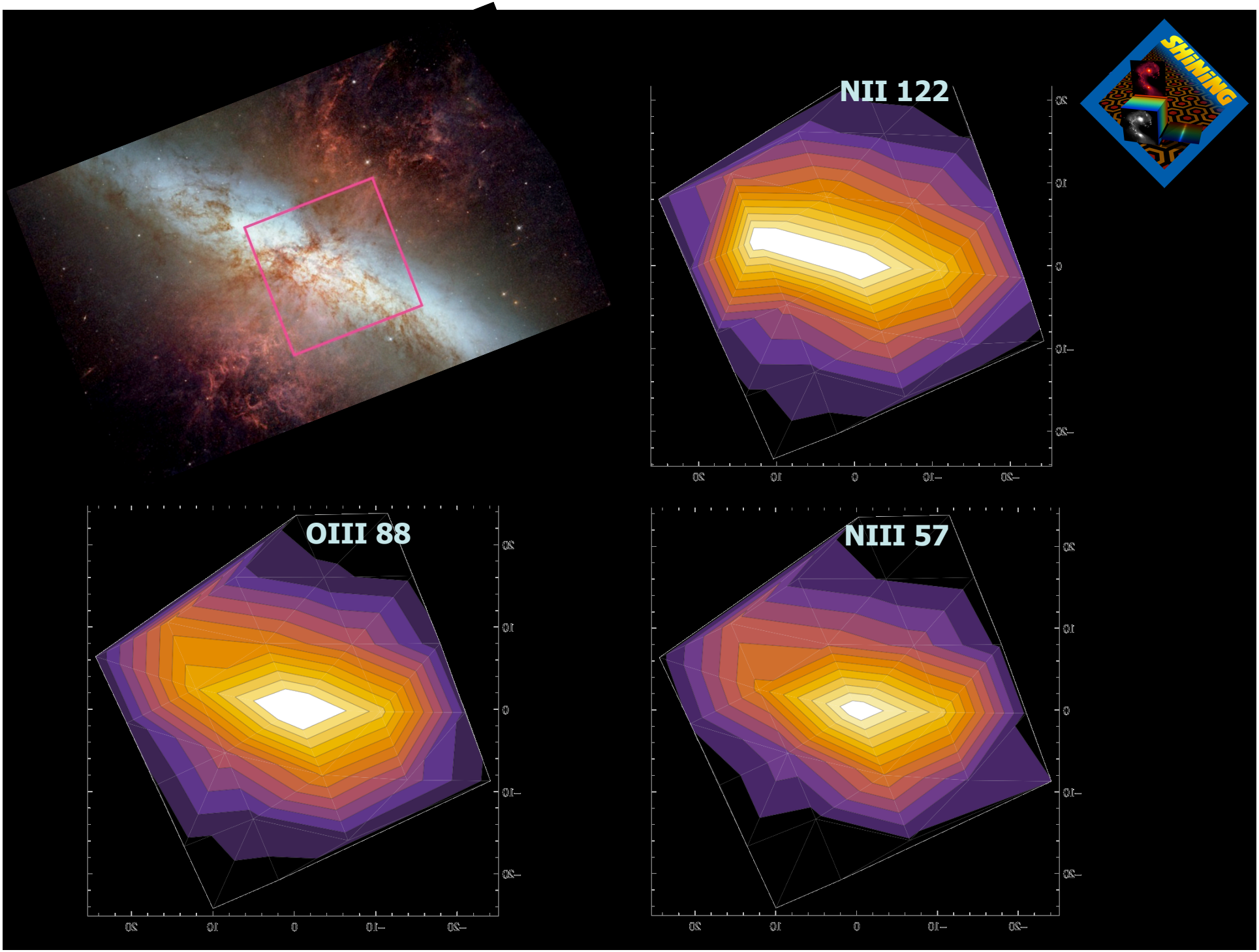


Single pointing vs. mapping

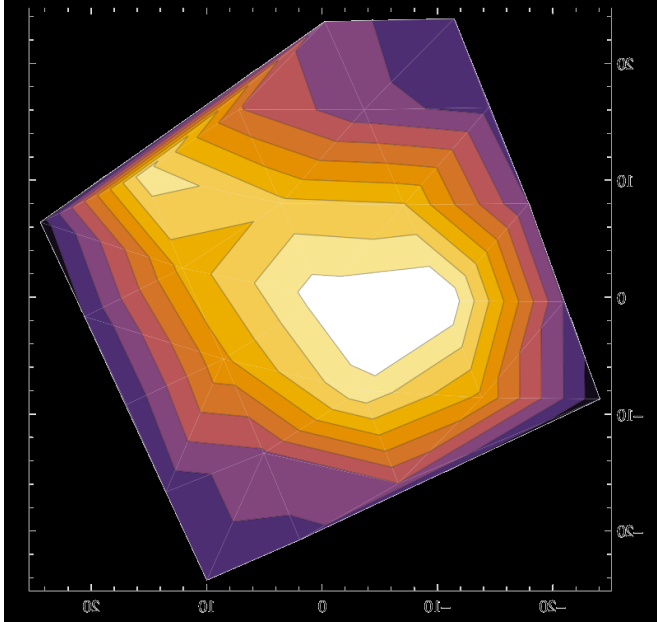
SCUBA 450 um map



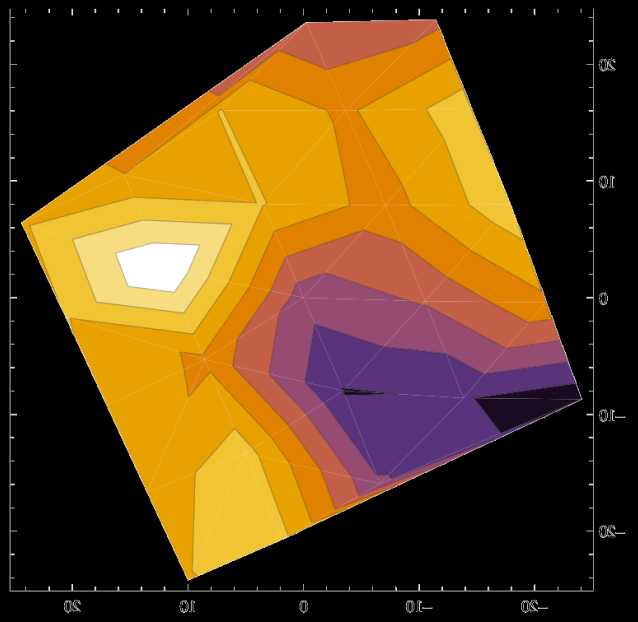

OI 63
CII 157
OI 145
SHINING


NII 122
OIII 88
NIII 57
SHINING

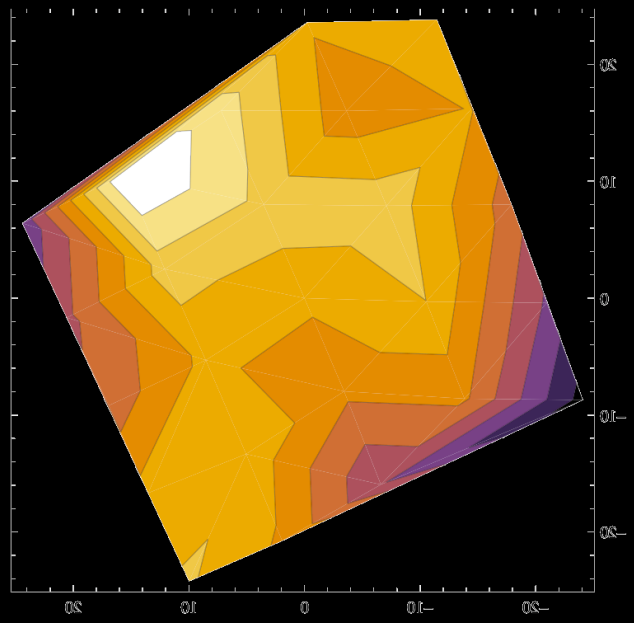
OIII 88 / CII 157



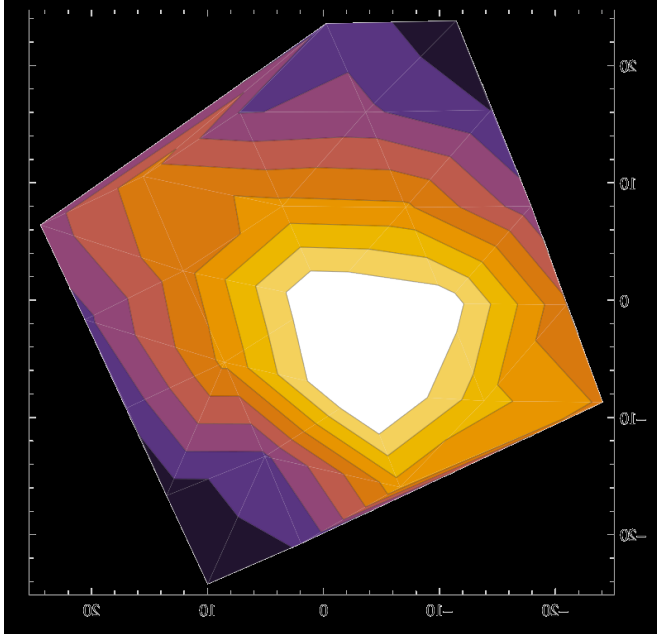
OI 145 / OI 63



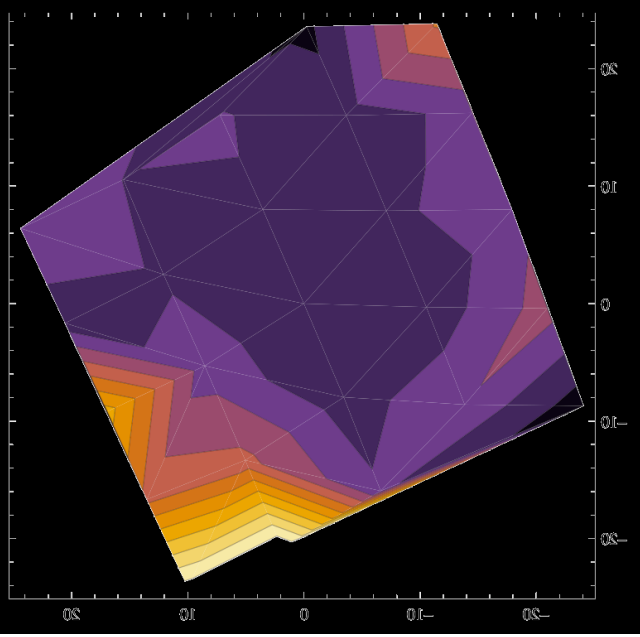
OIII 88 / OI 63

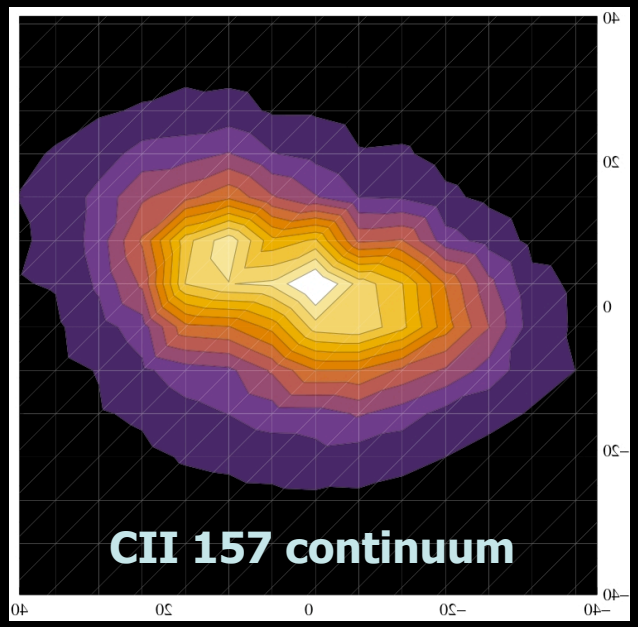


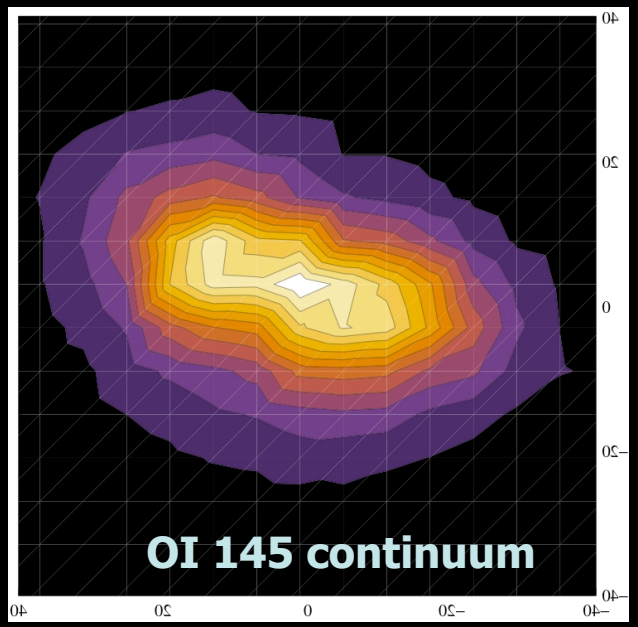
OI 63 / CII 157

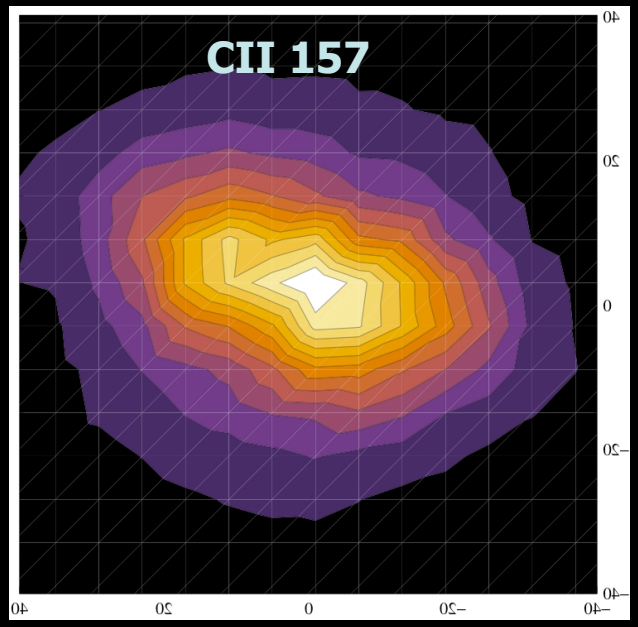


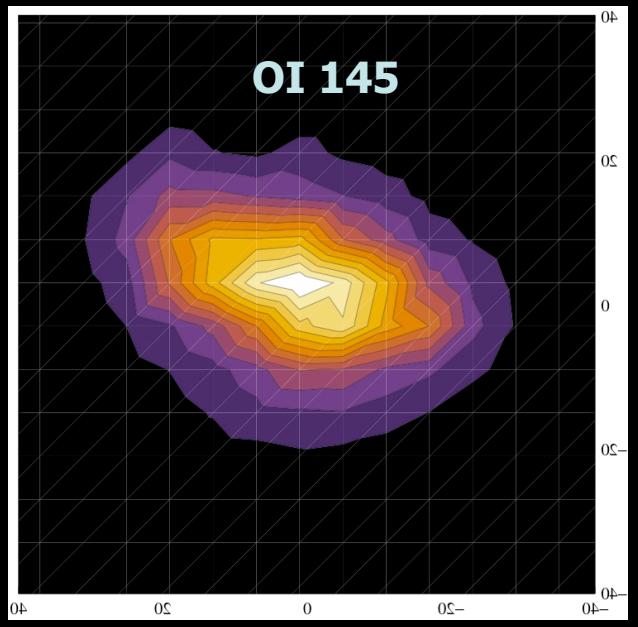
OIII 88 / NIII 57

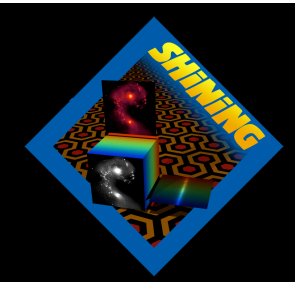



CII 157 continuum
40
20
0
−20
−40

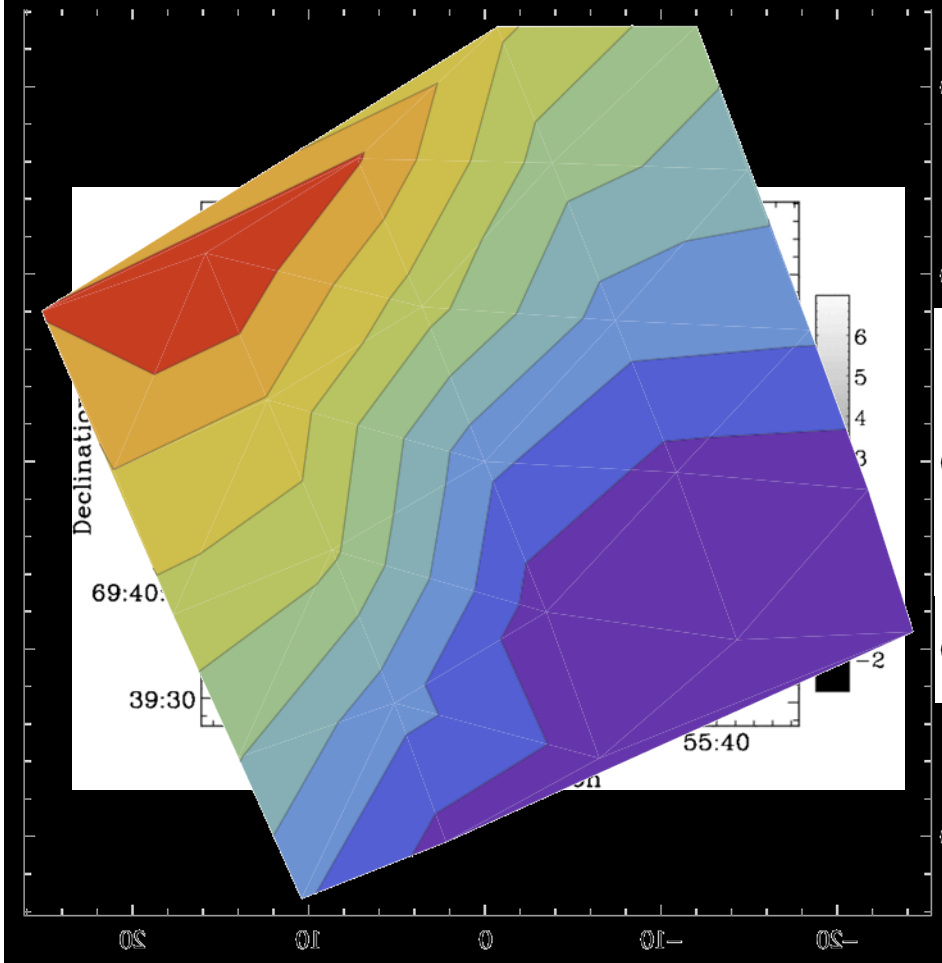

OI 145 continuum
40
20
0
−20
−40


CII 157
40
20
0
−20
−40

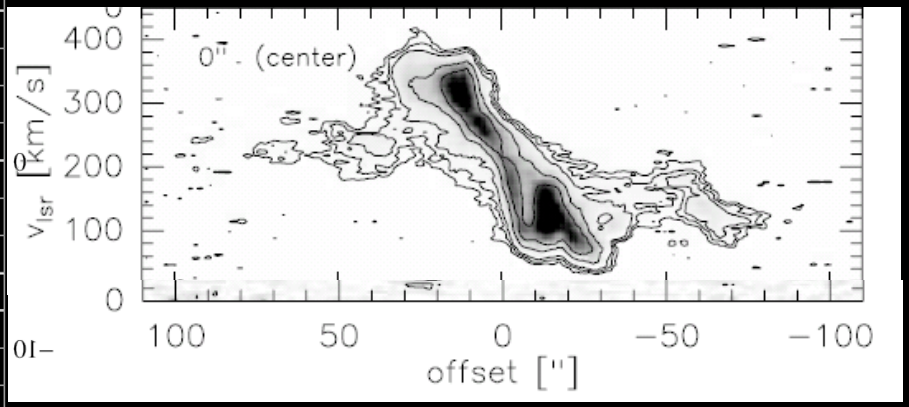

OI 145
40
20
0
−20
−40



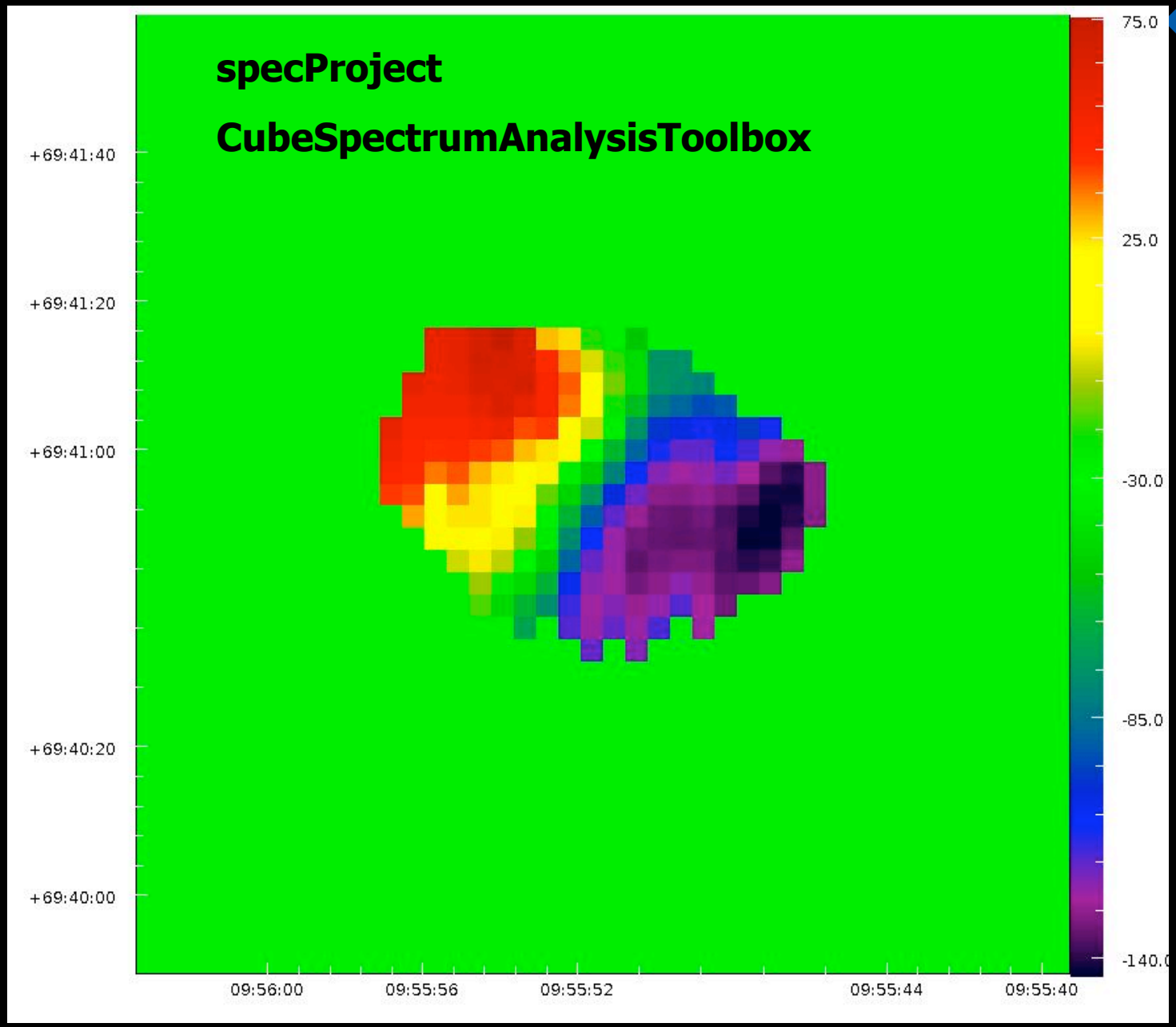
CII 2D velocity map (PACS)



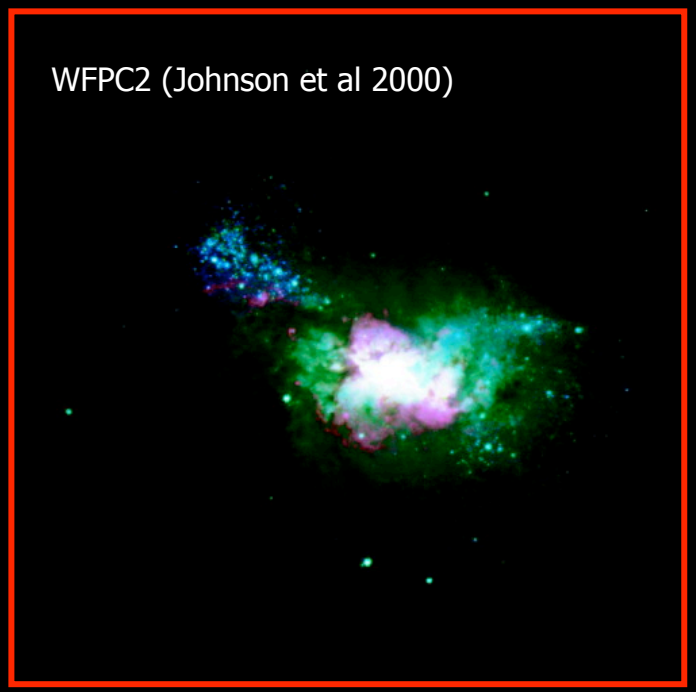
CO position-velocity map (OVRO)



Walter, Weiss & Scoville 2002


specProject
CubeSpectrumAnalysisToolbox
+69:41:40
+69:41:20
+69:41:00
+69:40:20
+69:40:00
09:56:00
09:55:56
09:55:52
09:55:44
09:55:40
75.0
25.0
-30.0
-85.0
-140.0

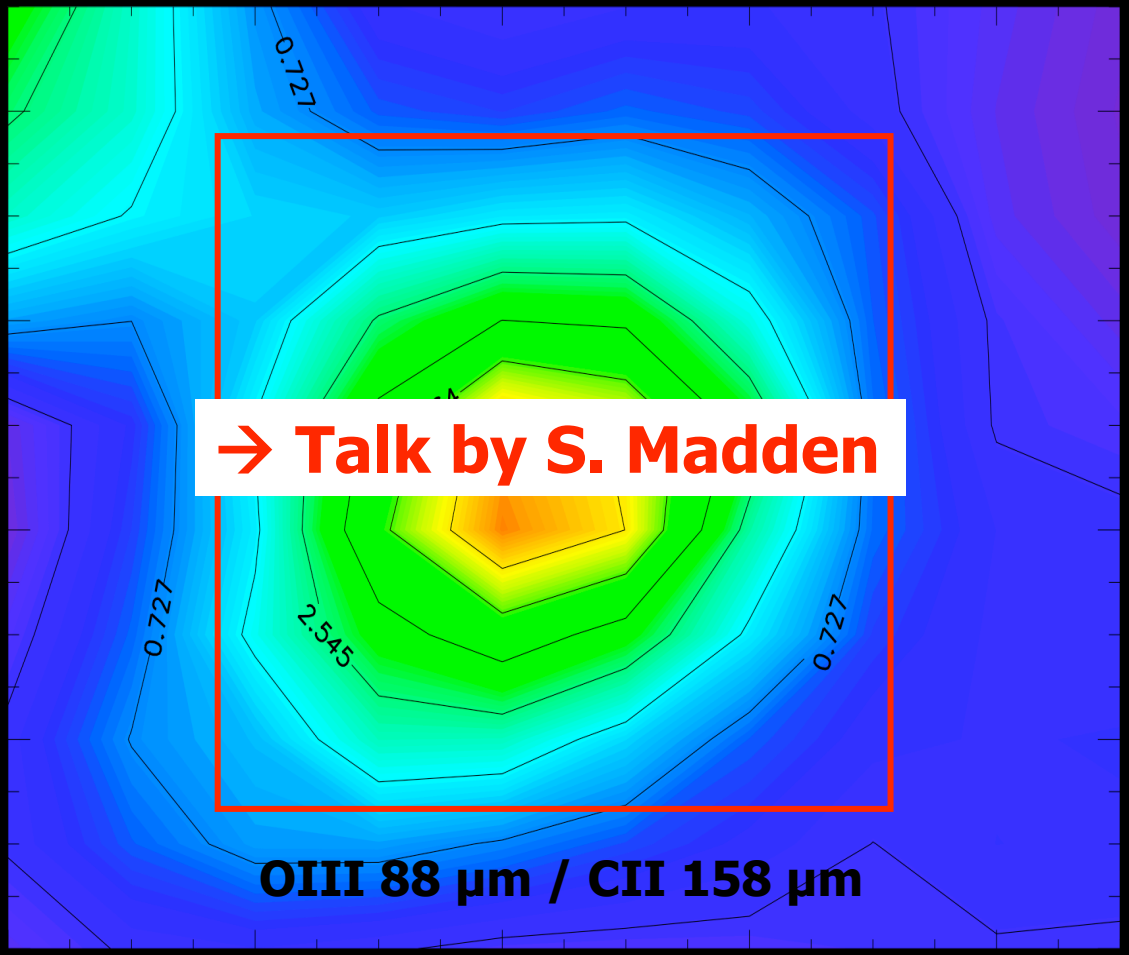
First Results from SDP III) Dwarfs / low metallicity



30 arc sec = 1.3 kpc

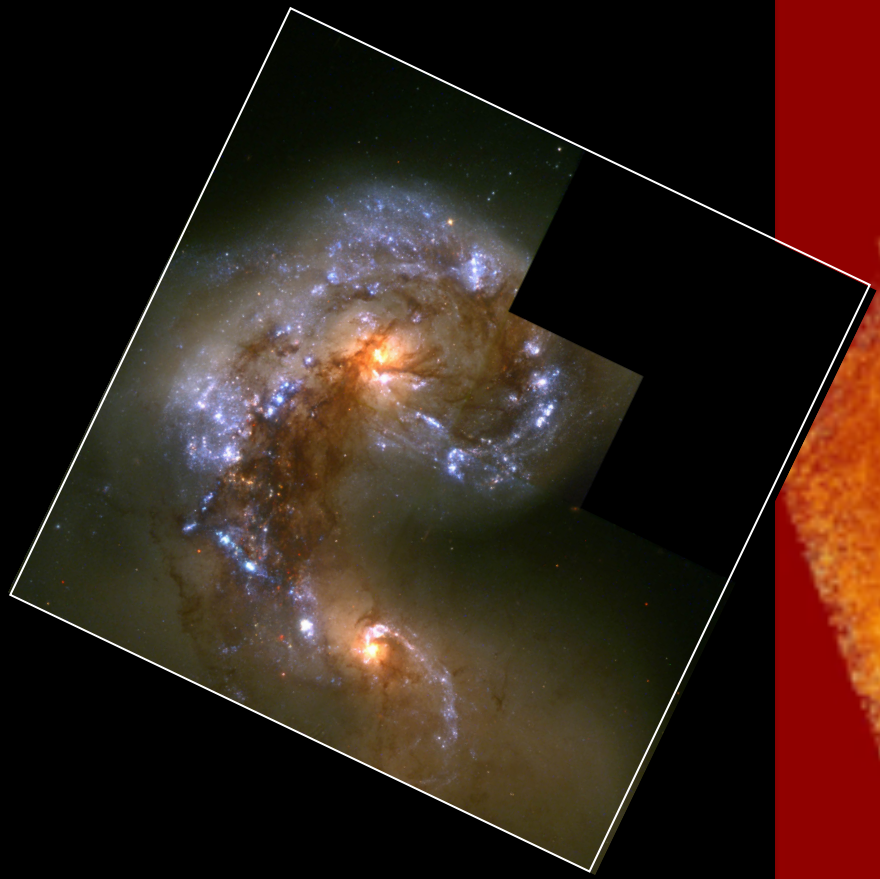
Hundreds of SSC: extent of hard radiation field and winds seen in unusually high OIII/CII ratios !

He 2-10



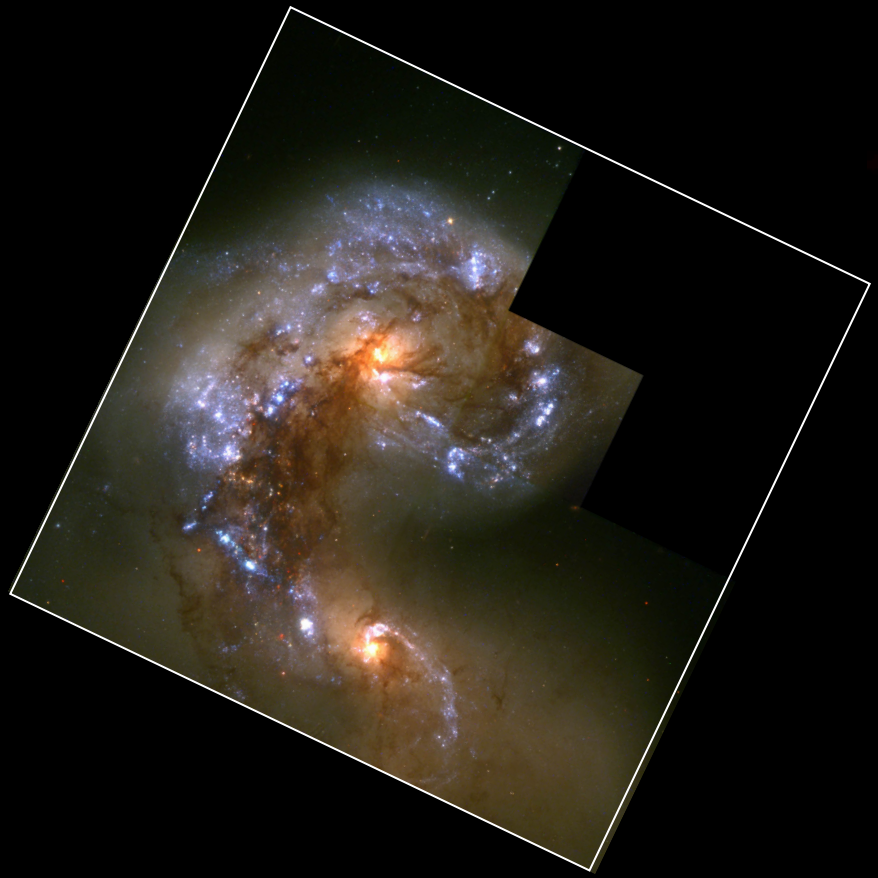
47 arc sec = 2 kpc

First Results from SDP IV) Imaging of Colliding Galaxies

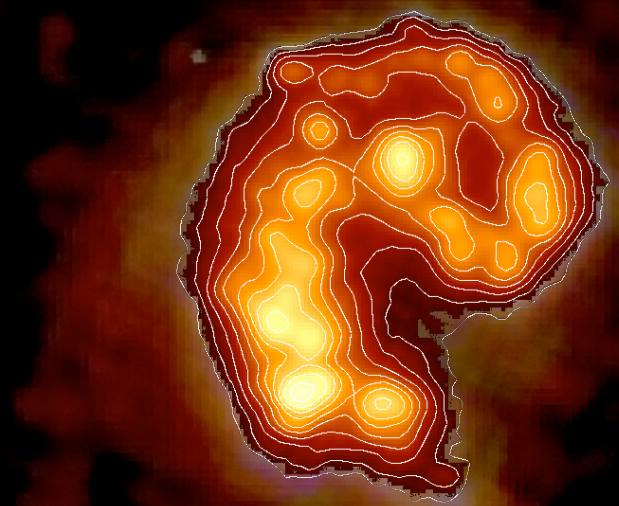


Hubble Space Telescope

First Results from SDP IV) Imaging of Colliding Galaxies

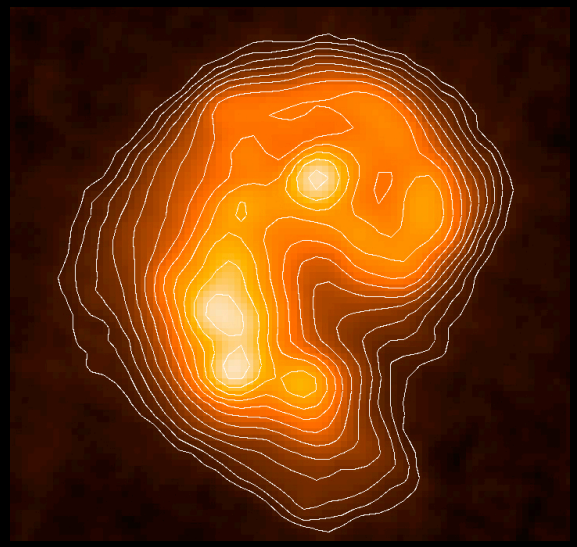


Hubble Space Telescope

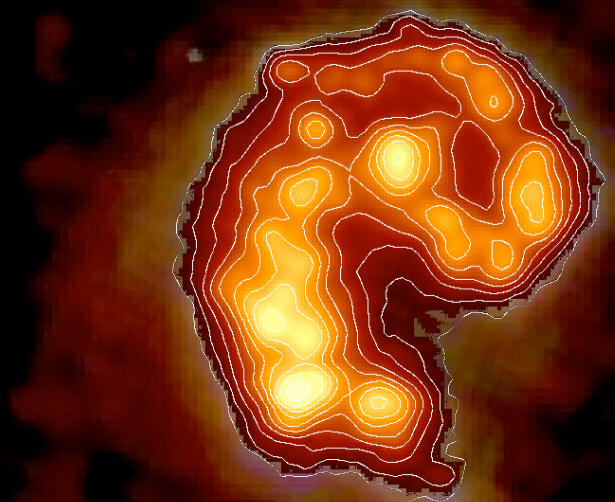


Herschel-PACS

First Results from SDP IV) Imaging of Colliding Galaxies

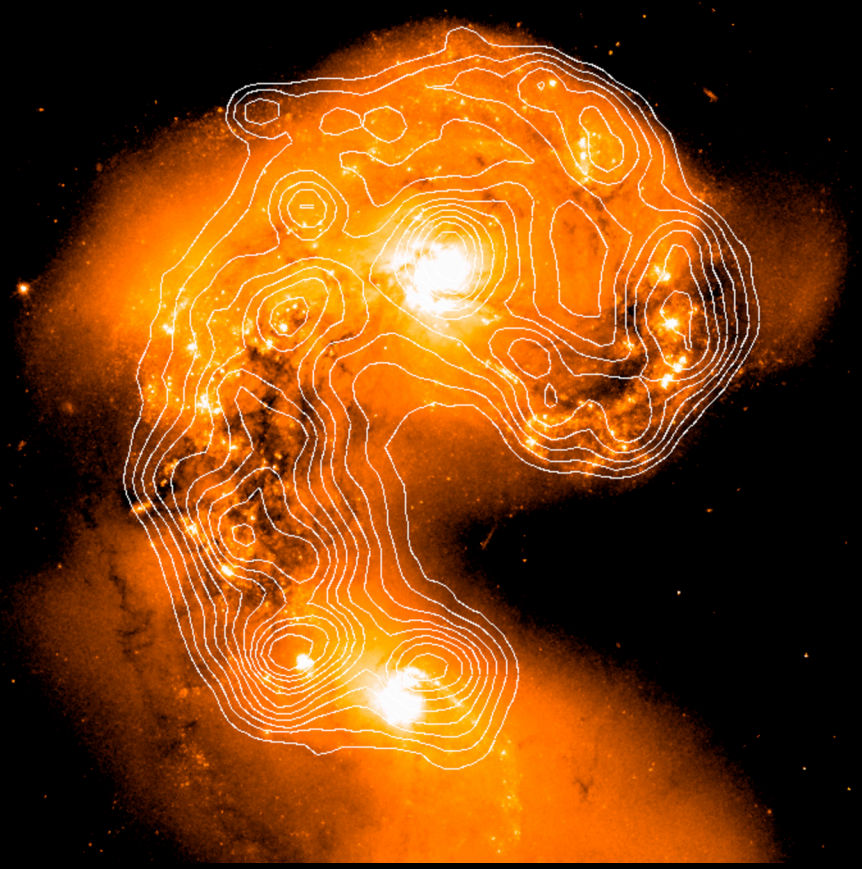


PACS 160 µm



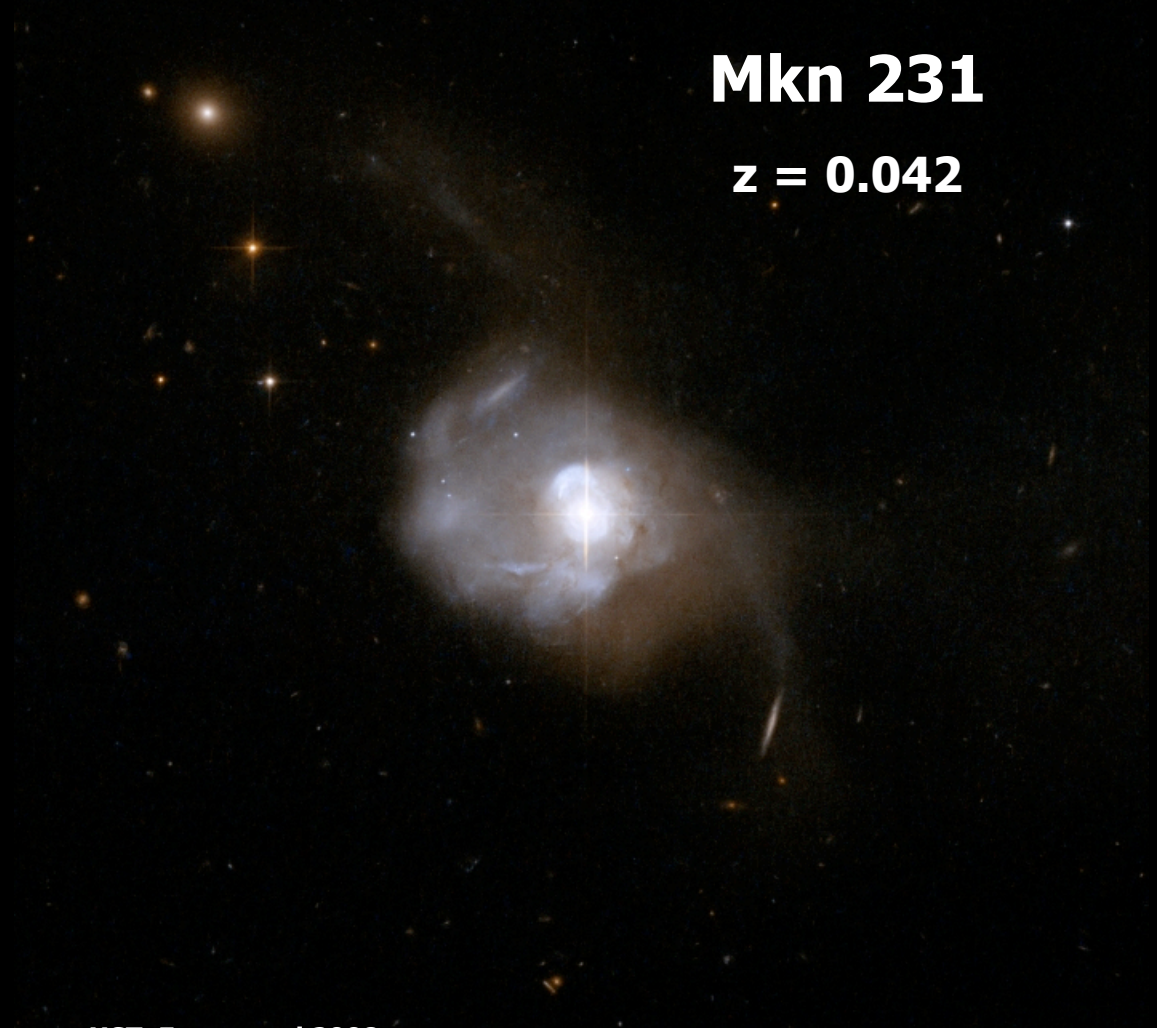
PACS 70 µm

First Results from SDP IV) Imaging of Colliding Galaxies



PACS 160 μm vs. HST (ACS red)

First Results from SDP
V) ULIRGs (low z)

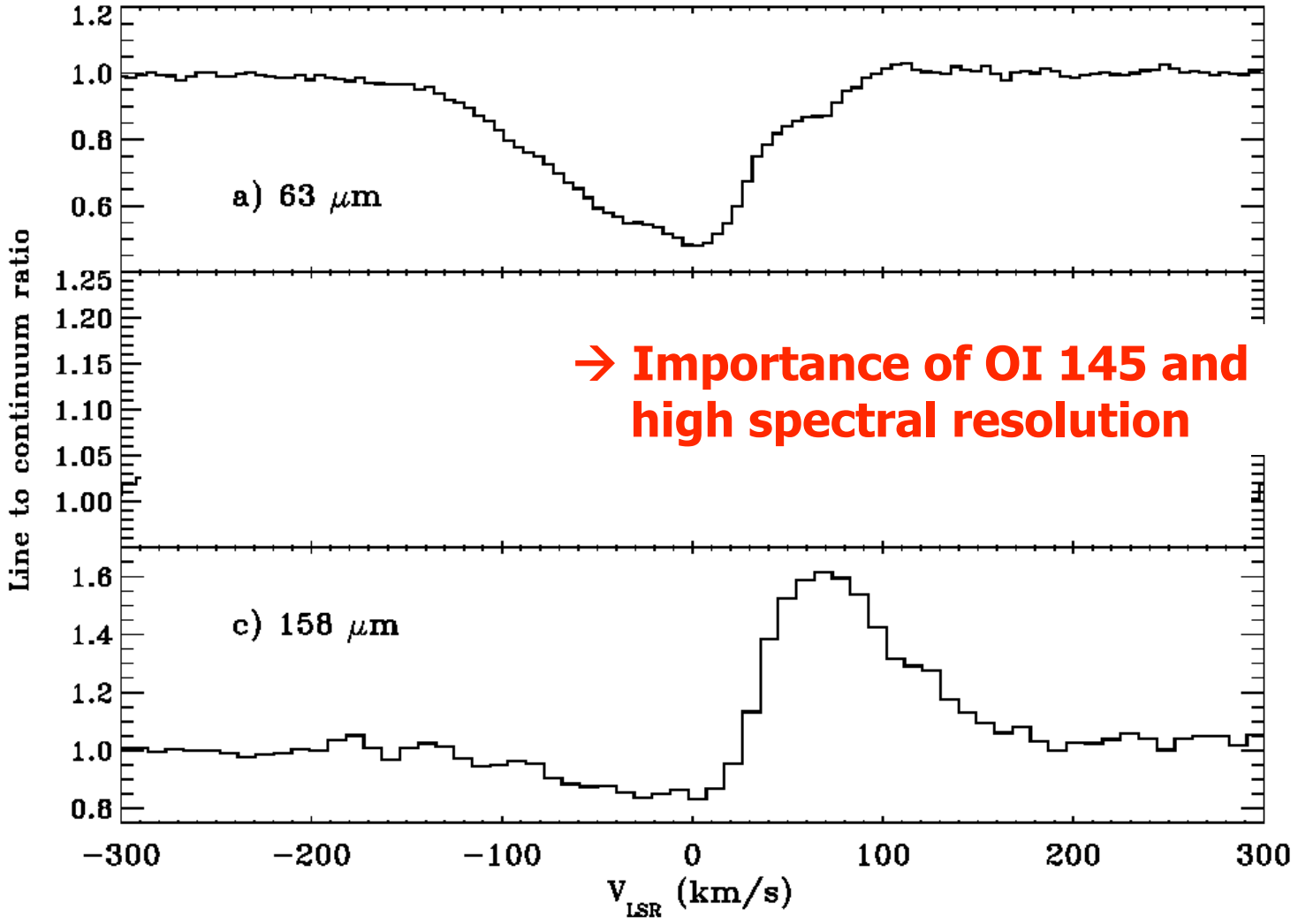


Mkn 231

z = 0.042

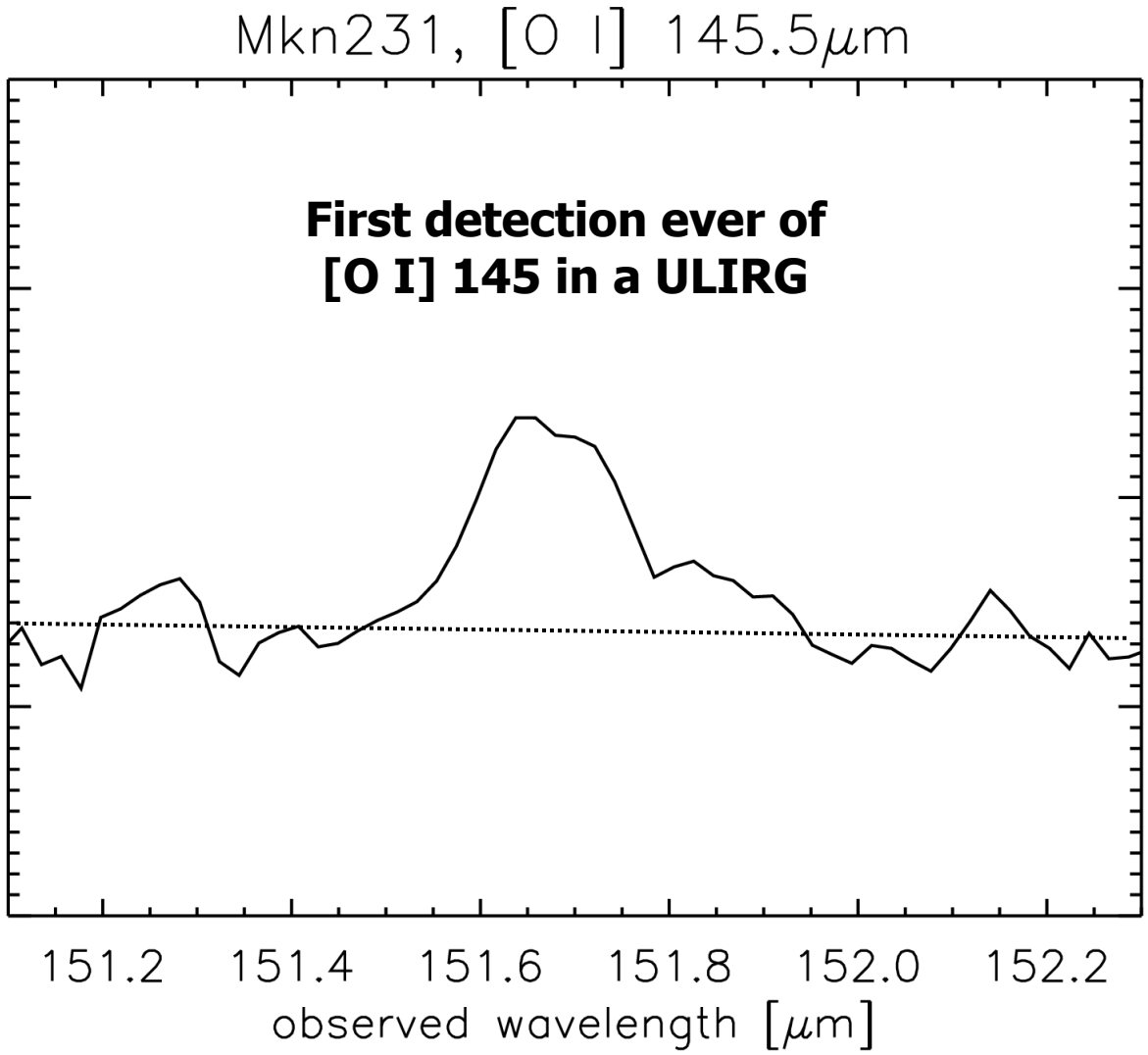
HST, Evans et al 2008

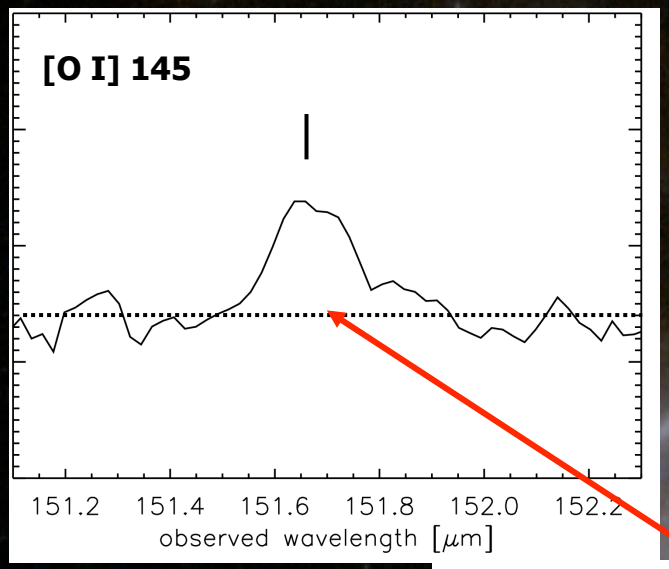
A) [O I] 145 (C+ deficit)

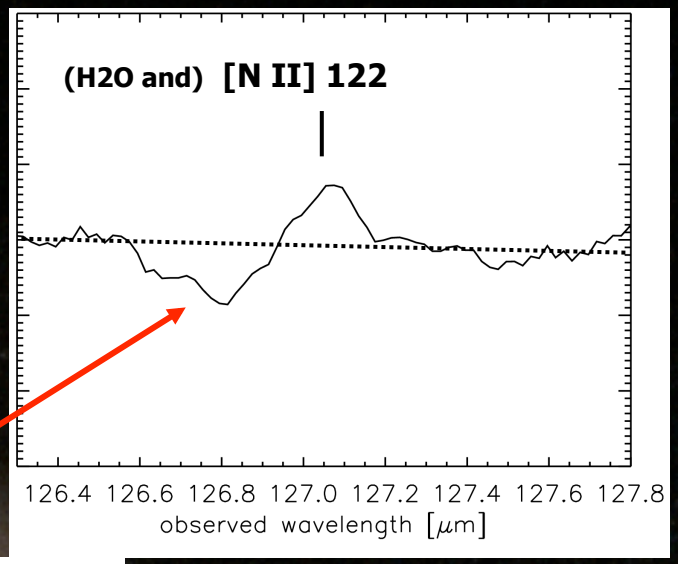


→ Importance of OI 145 and high spectral resolution

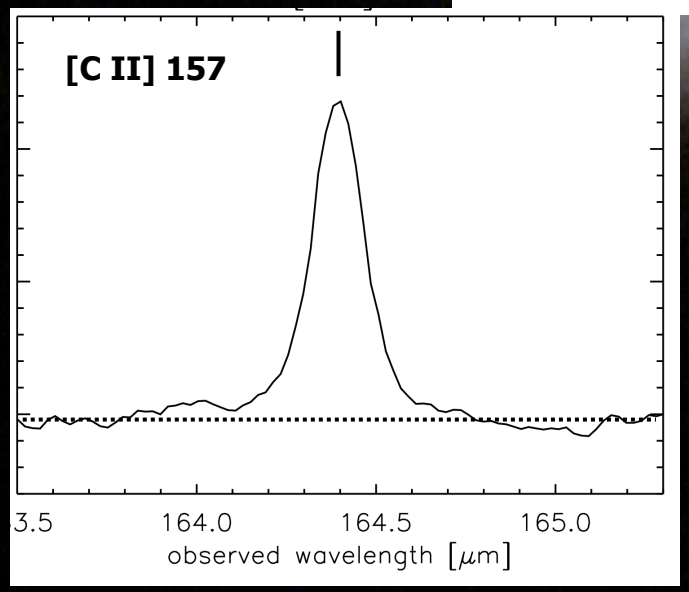
Sgr B2, Vastel et al. 2002

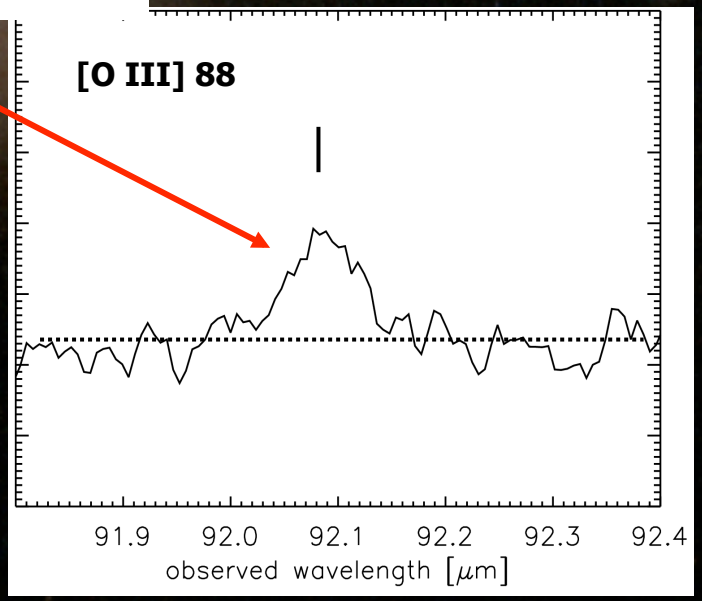

Mkn231, [O I] 145.5μm
First detection ever of
[O I] 145 in a ULIRG
151.2
151.4
151.6
151.8
152.0
152.2
observed wavelength [μm]



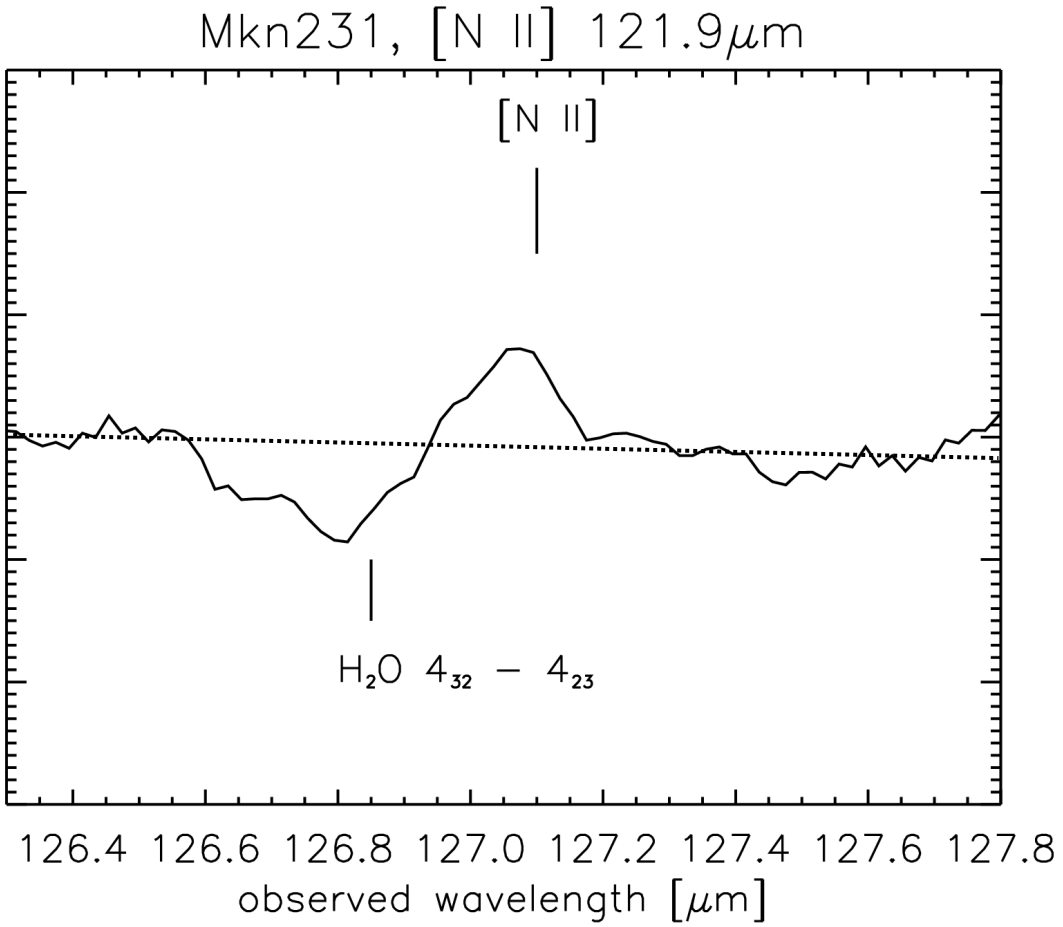


First detection in a ULIRG

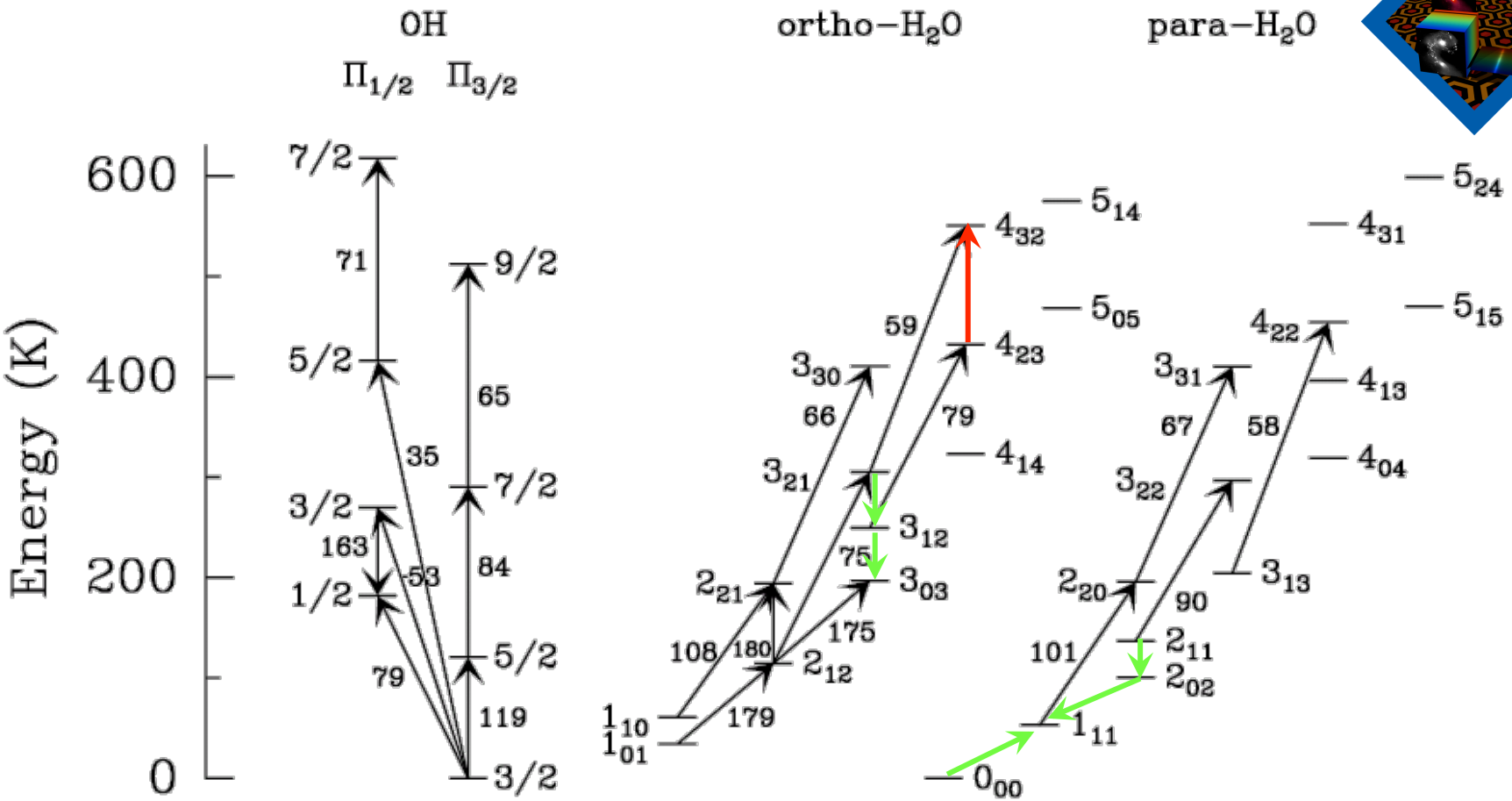




B) H2O



First detection ever of H_2O 4_{32}-4_{23} in a ULIRG (highest energy level reported so far)



Arp220 ISO-LWS Water line detections, Gonzalez-Alfonso et al. 2004

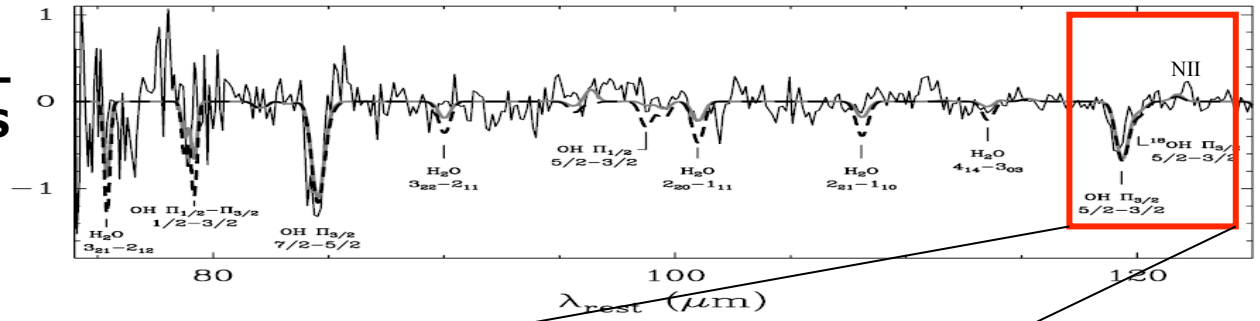
SPIRE (web release)

PACS, **Mkn231** (SDP)

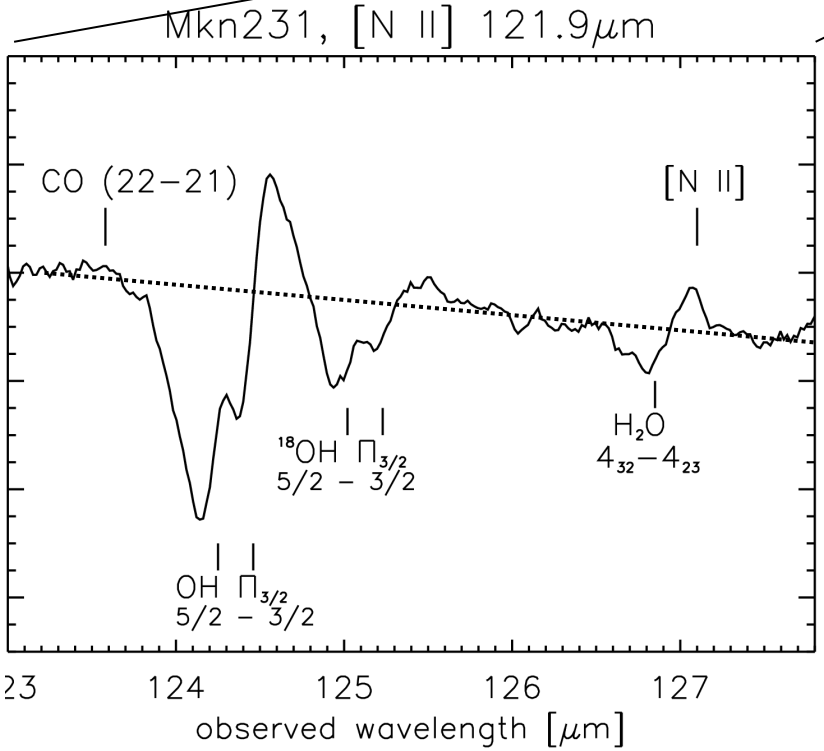
→ Talks by C. Wilson and P. van der Werf

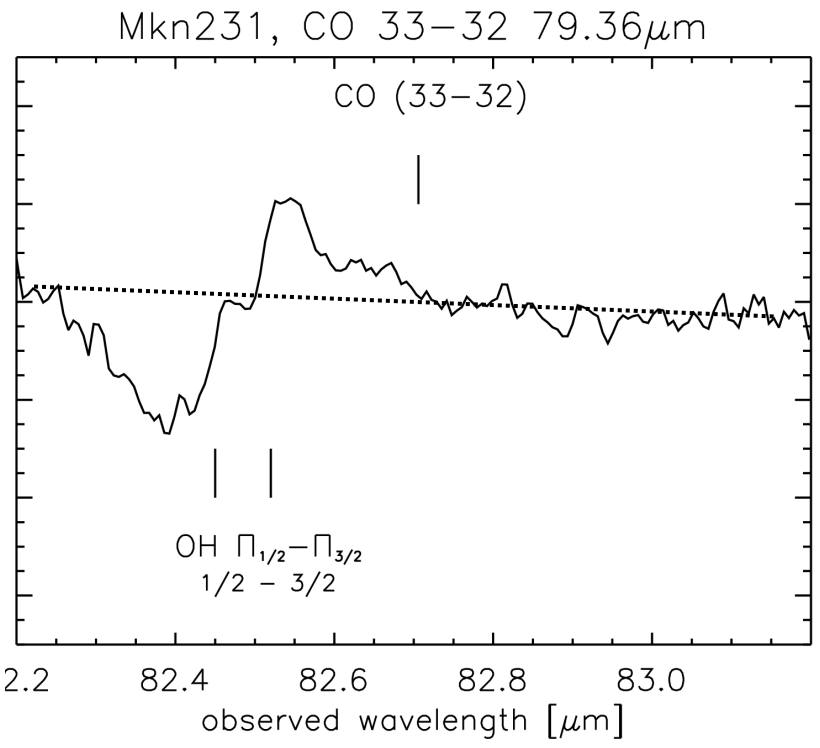
C) OH

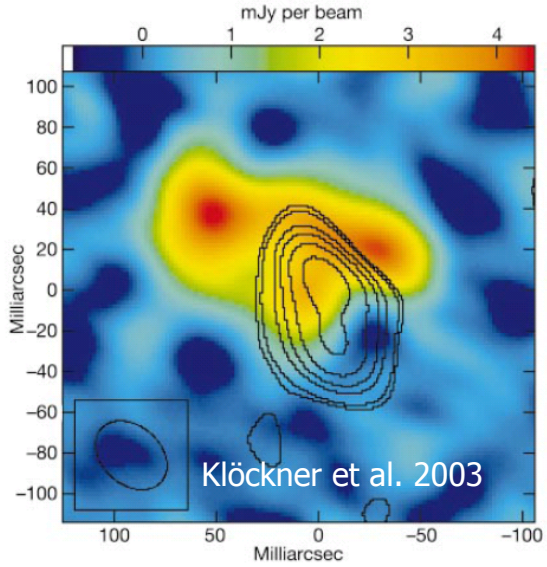
ISO-LWS



PACS







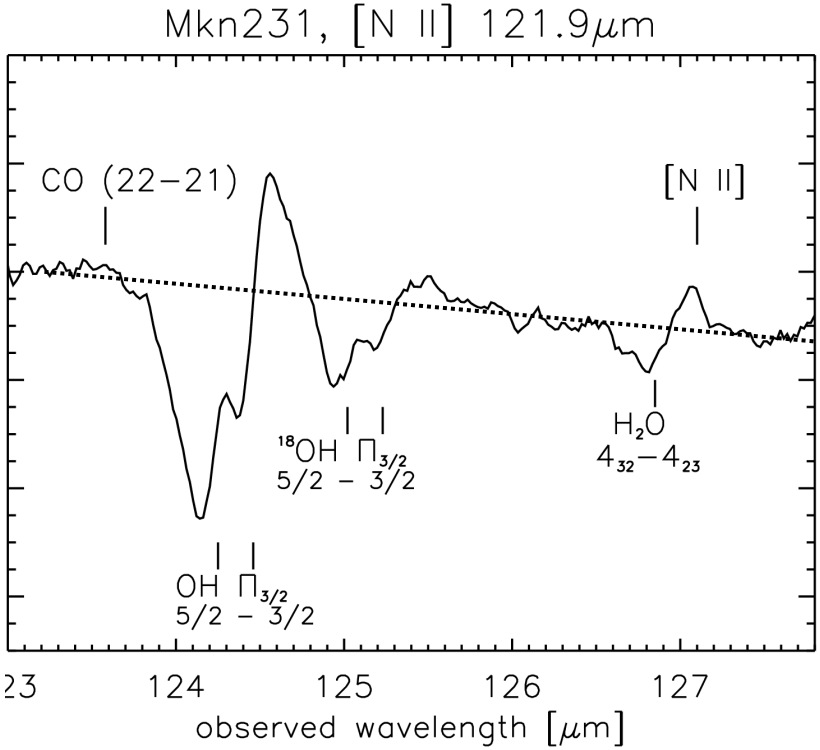
C) OH

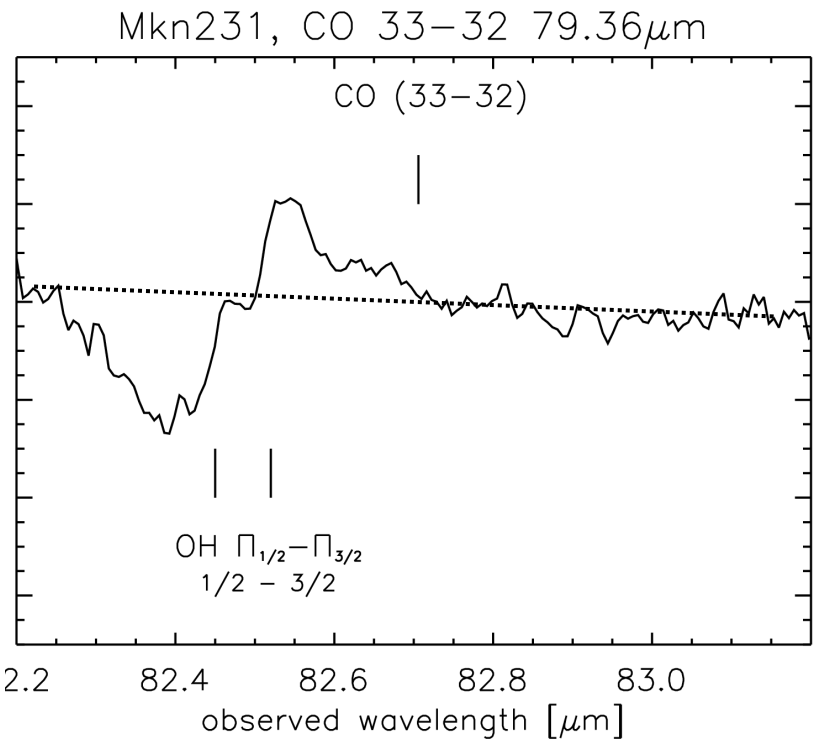
Outflow ?

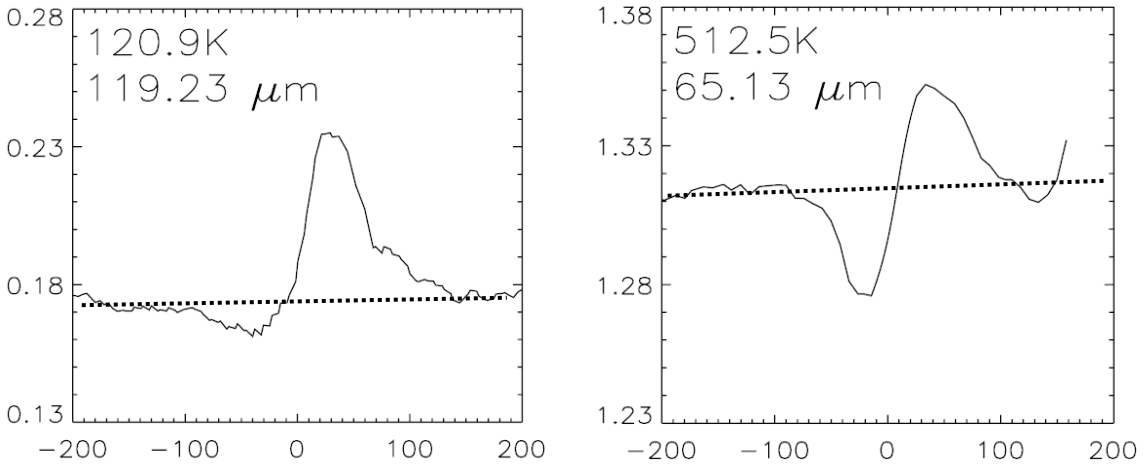
XDR ? Shocks ?

Maser pumping ?

PACS



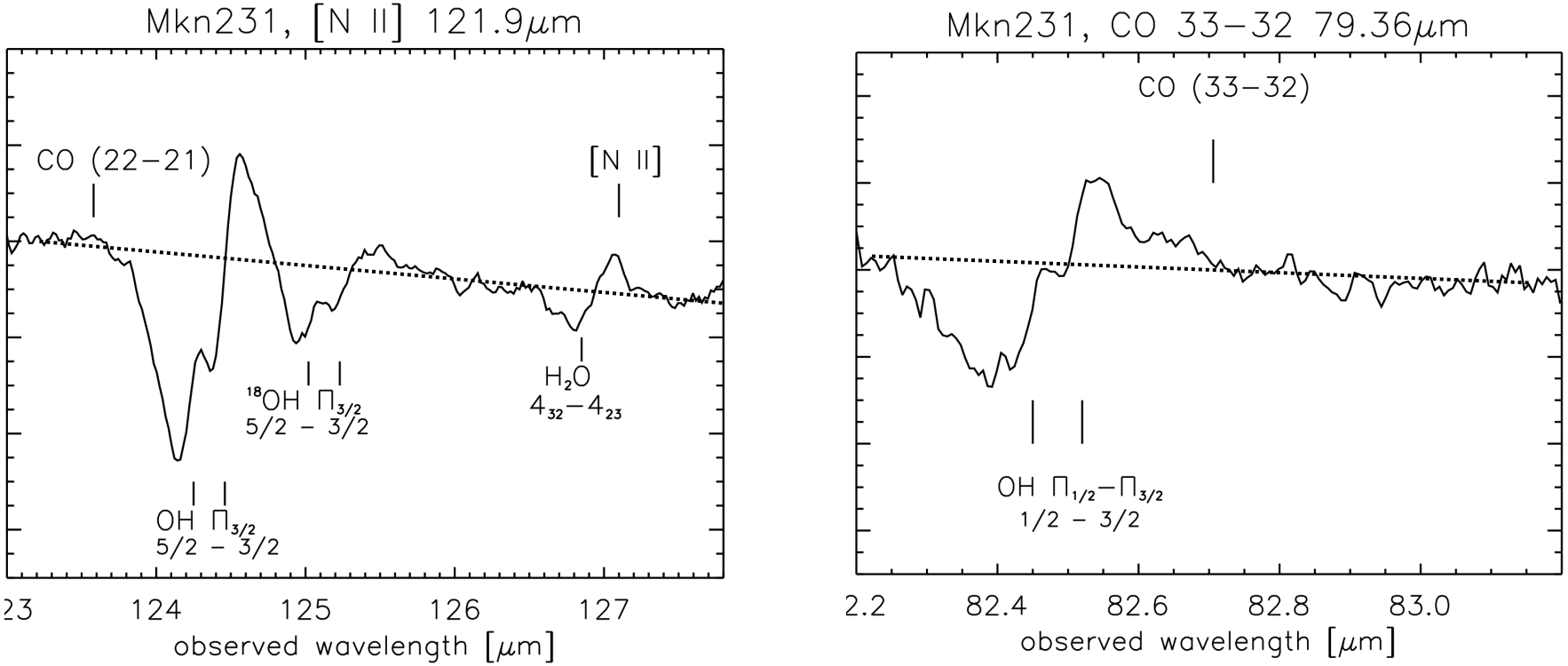




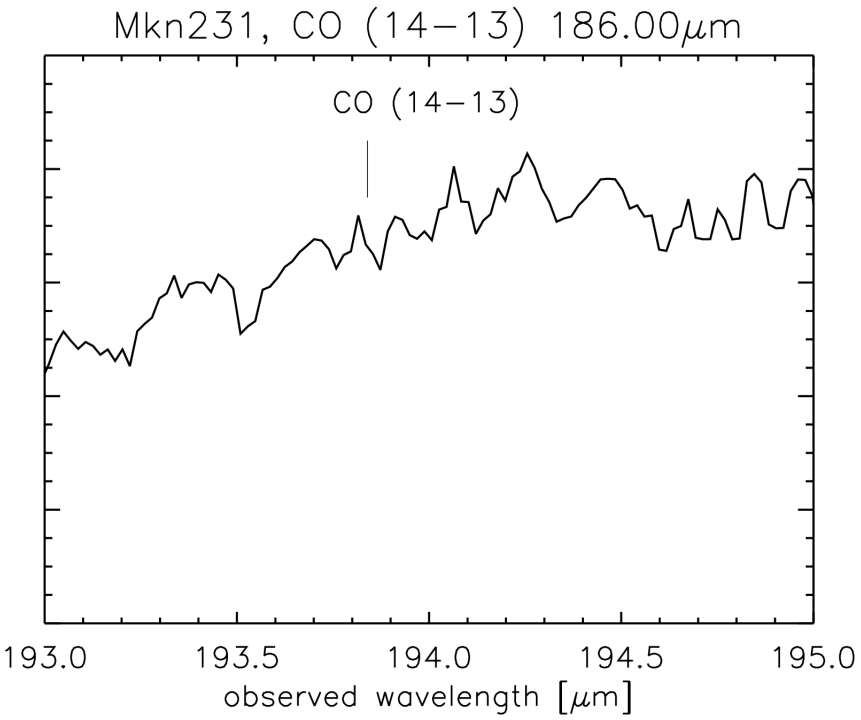
Orion KL outflow

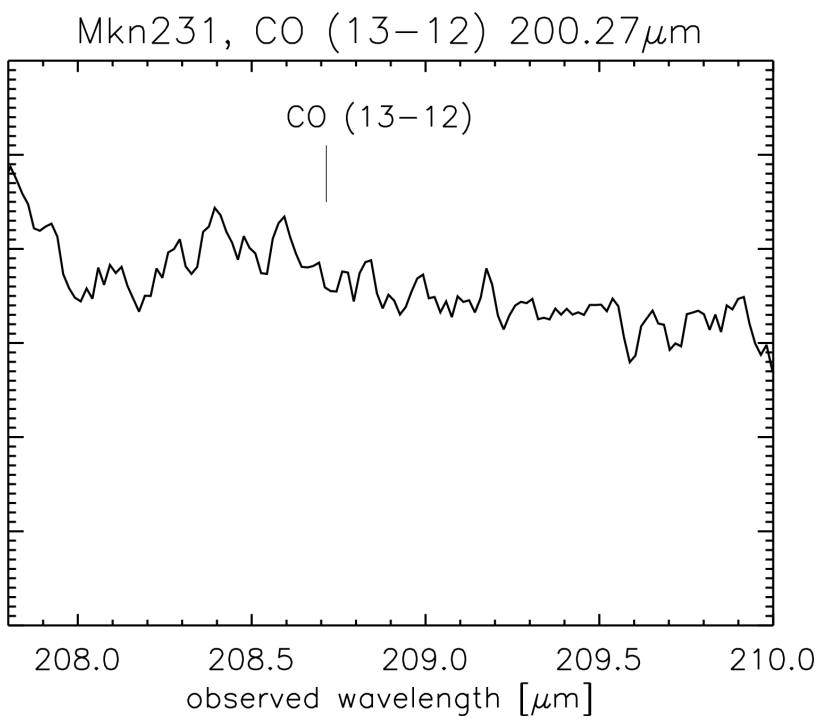
Lerate et al. 2006

PACS



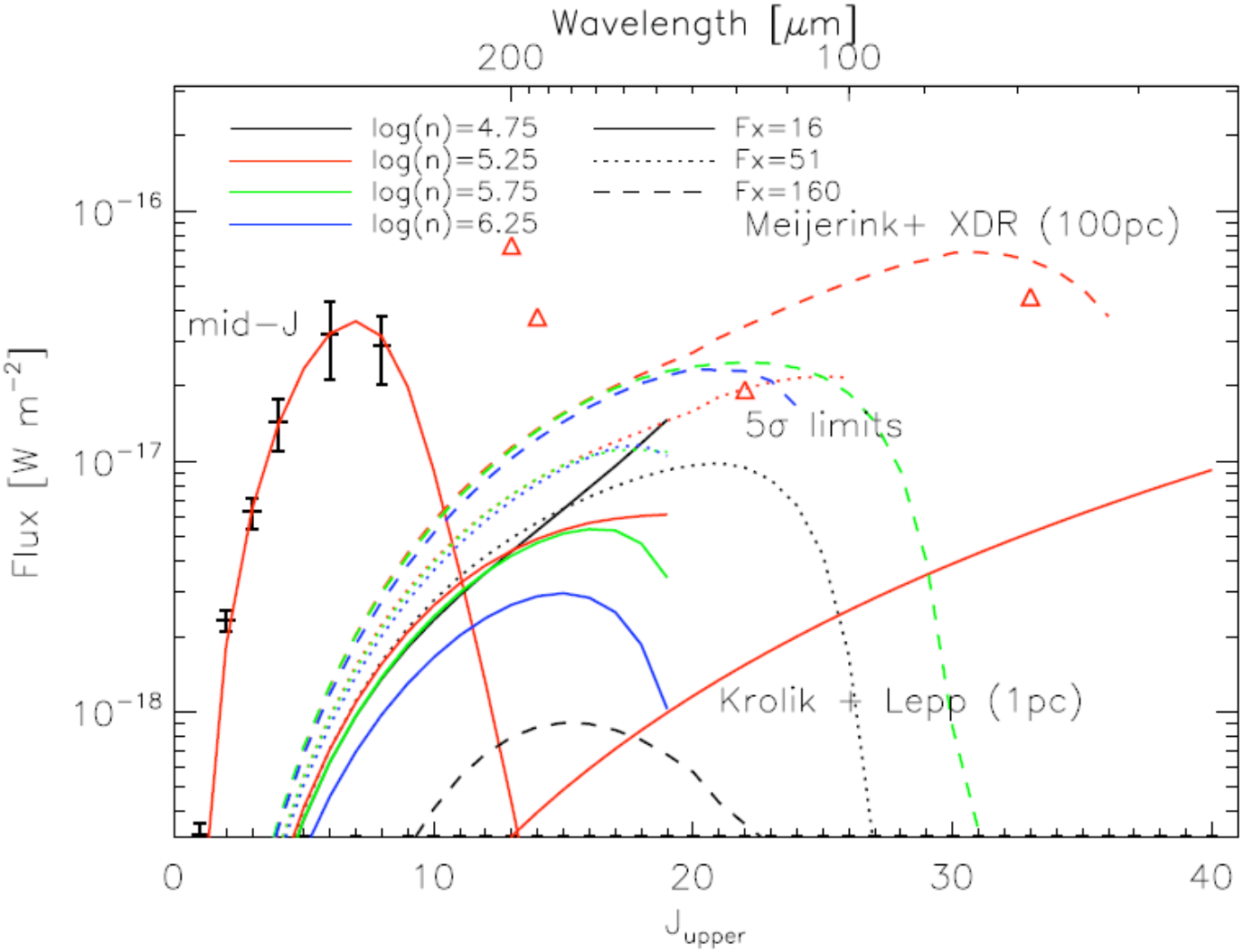
D) CO





1 scan each,

→ upper limits only



- Importance of CO as cooling line in ULIRGs

- XDR vs PDR (AGN vs. SB)

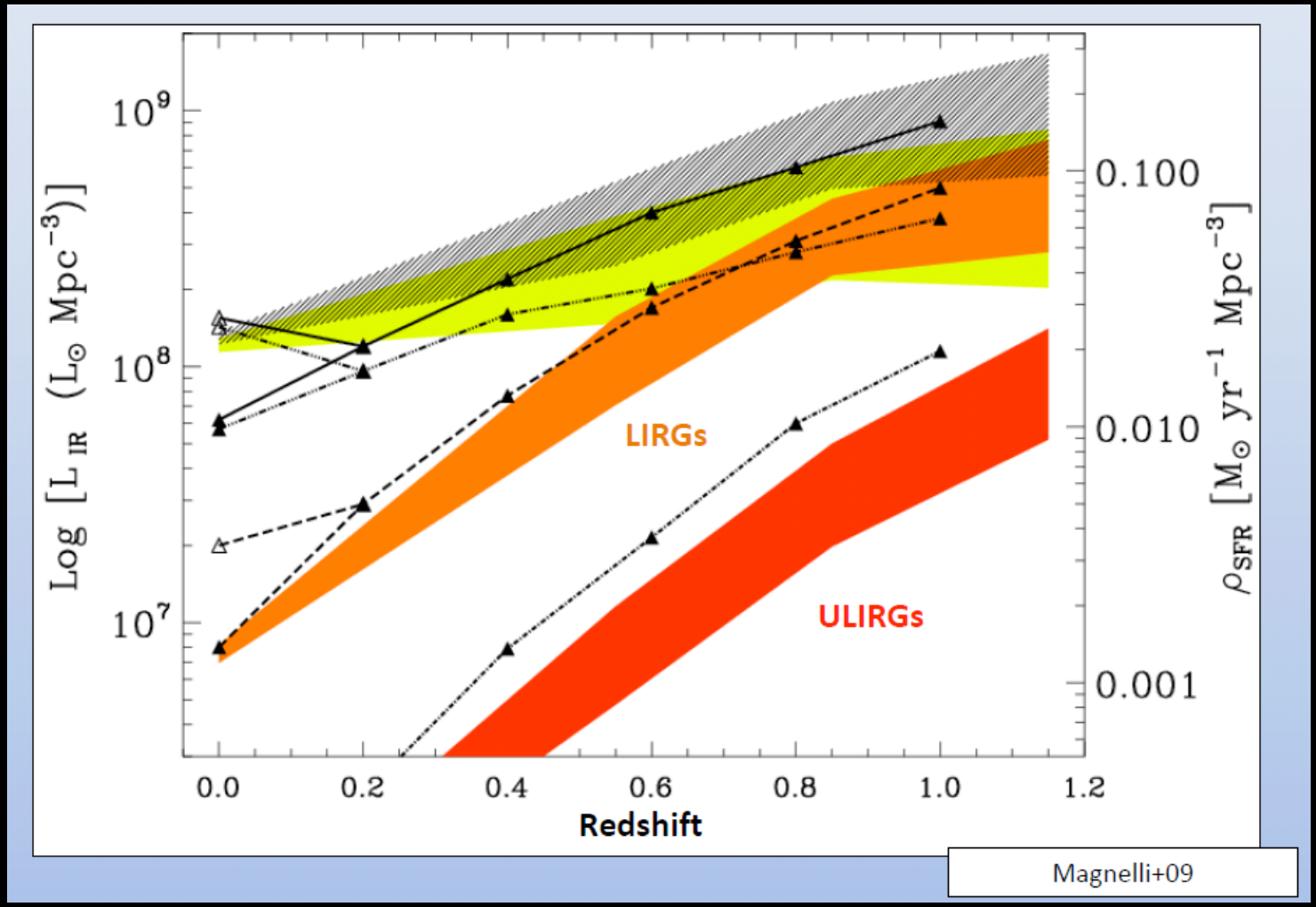
- comparison to AGN templates

- calibration of CO as tracer of high z galaxies

- ...

First Results from SDP
VI) ULIRGs (high z)

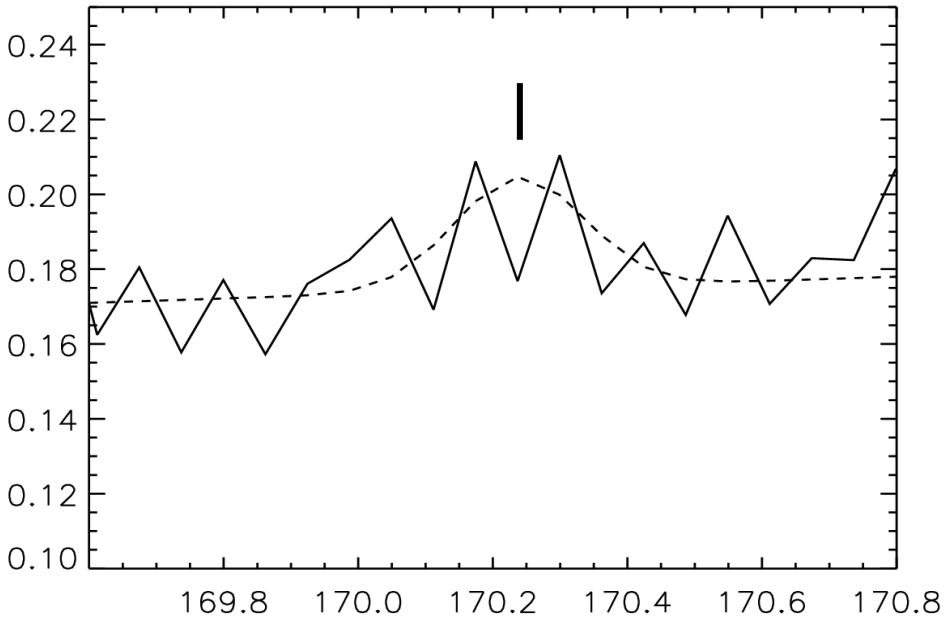
KP The Dusty Young Universe
(PI K. Meisenheimer)

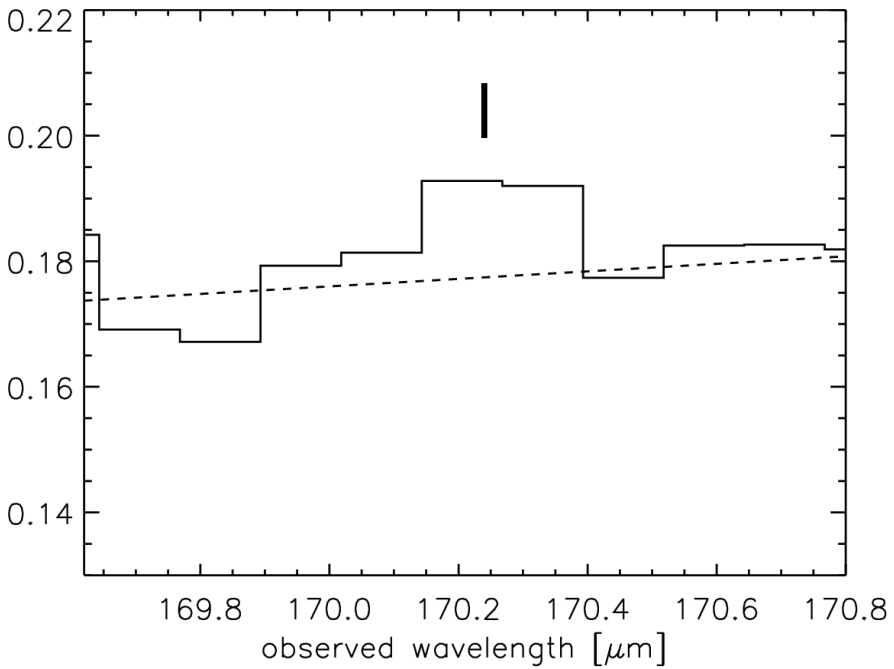


F10214+4724

z = 2.2856

[O III] 51.8μm





F (3σ) = 8x10^{-23} W/cm^2

1σ = 7 mJy