UNIVERSITY OF DENVER

The Herschel Planetary Nebulae Survey: new insights on Planetary Nebulae haloes

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& the HerPlaNS consortium

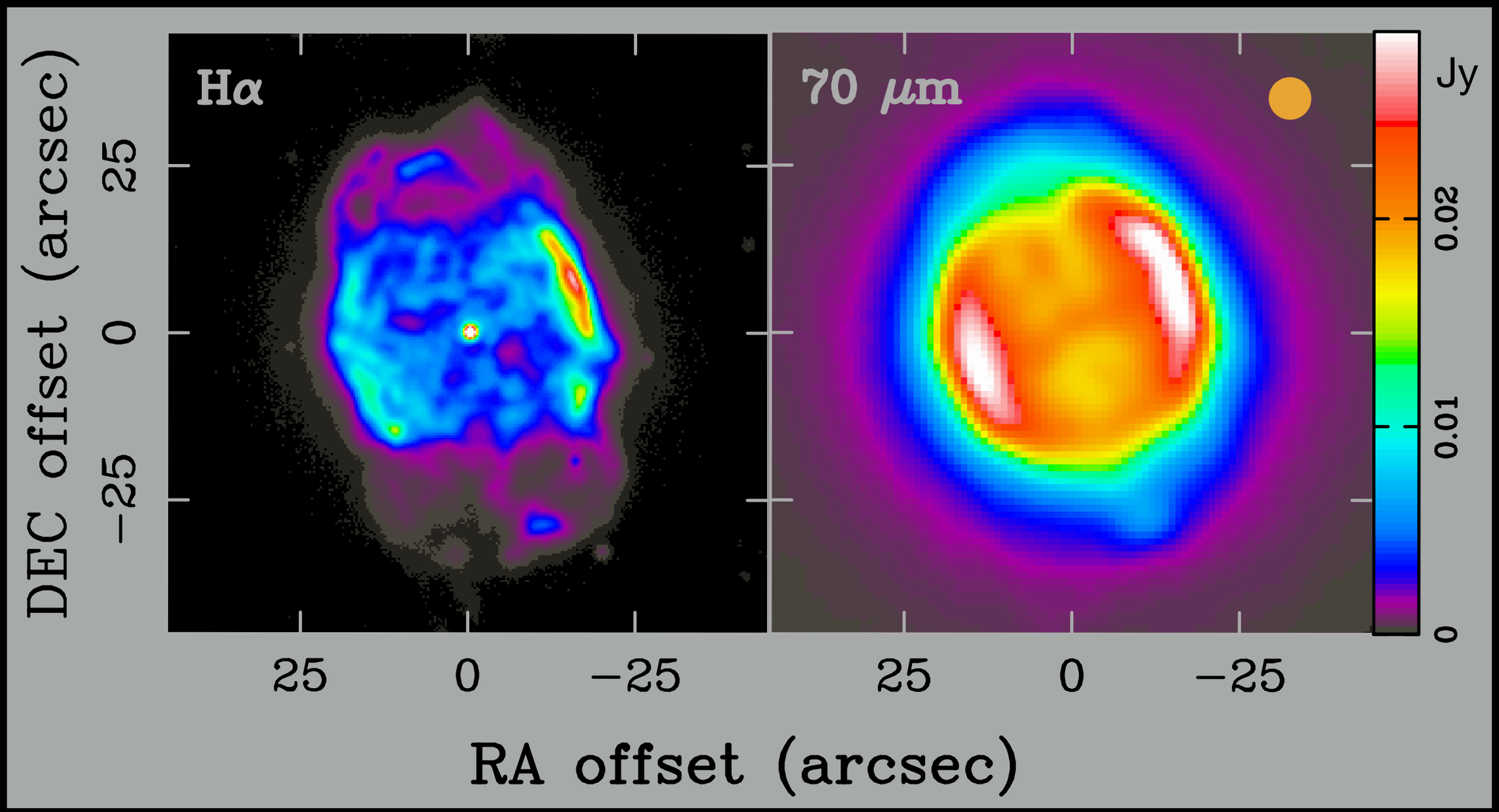
APNVI, Playa de Carmen, Mexico
06/11/2013

NGC 6543

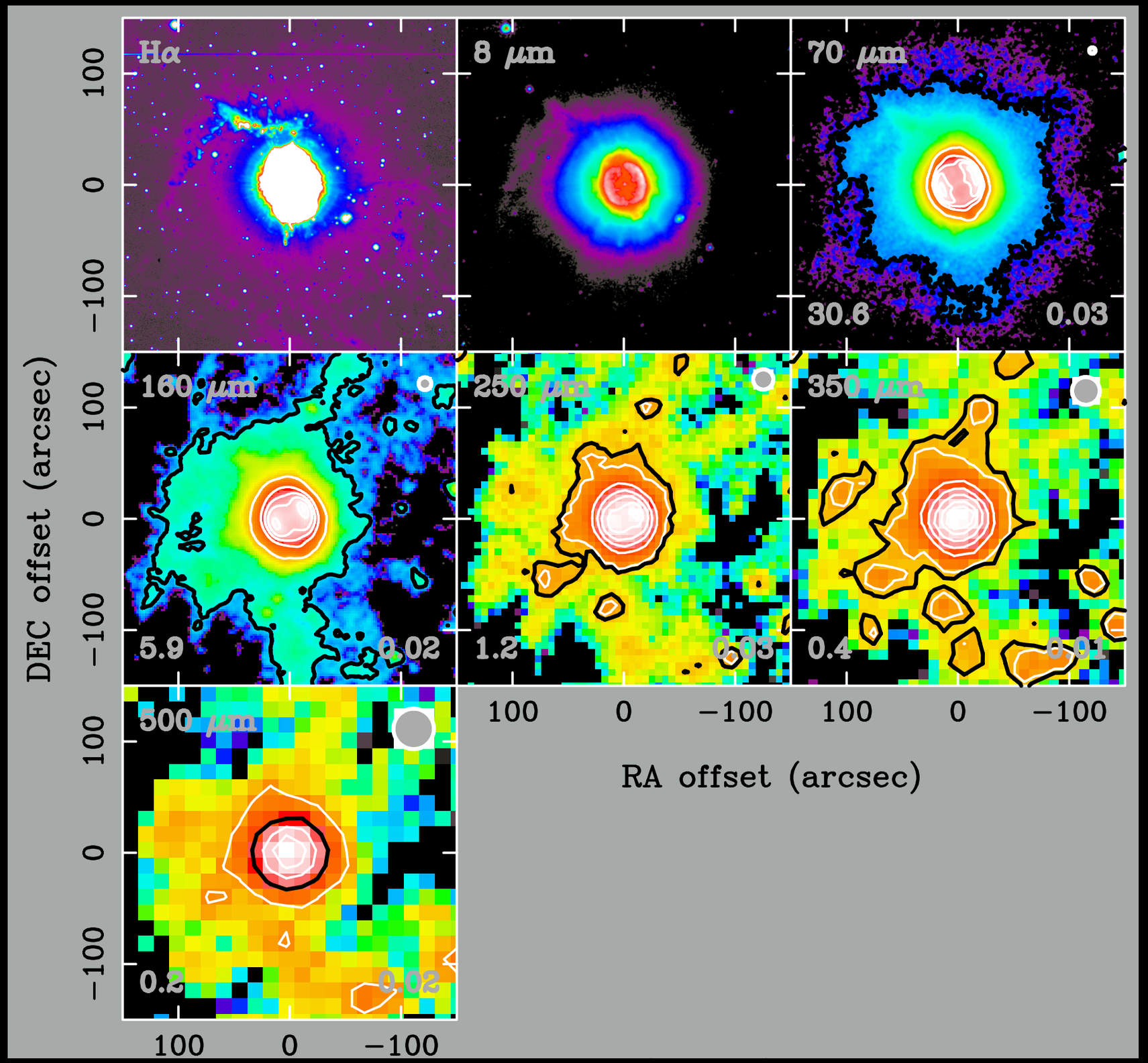
HerPlaNS photometry observations

Compared to optical narrow band images courtesy of R. Corradi
and Spitzer mid-IR data provided to us by J. Hora

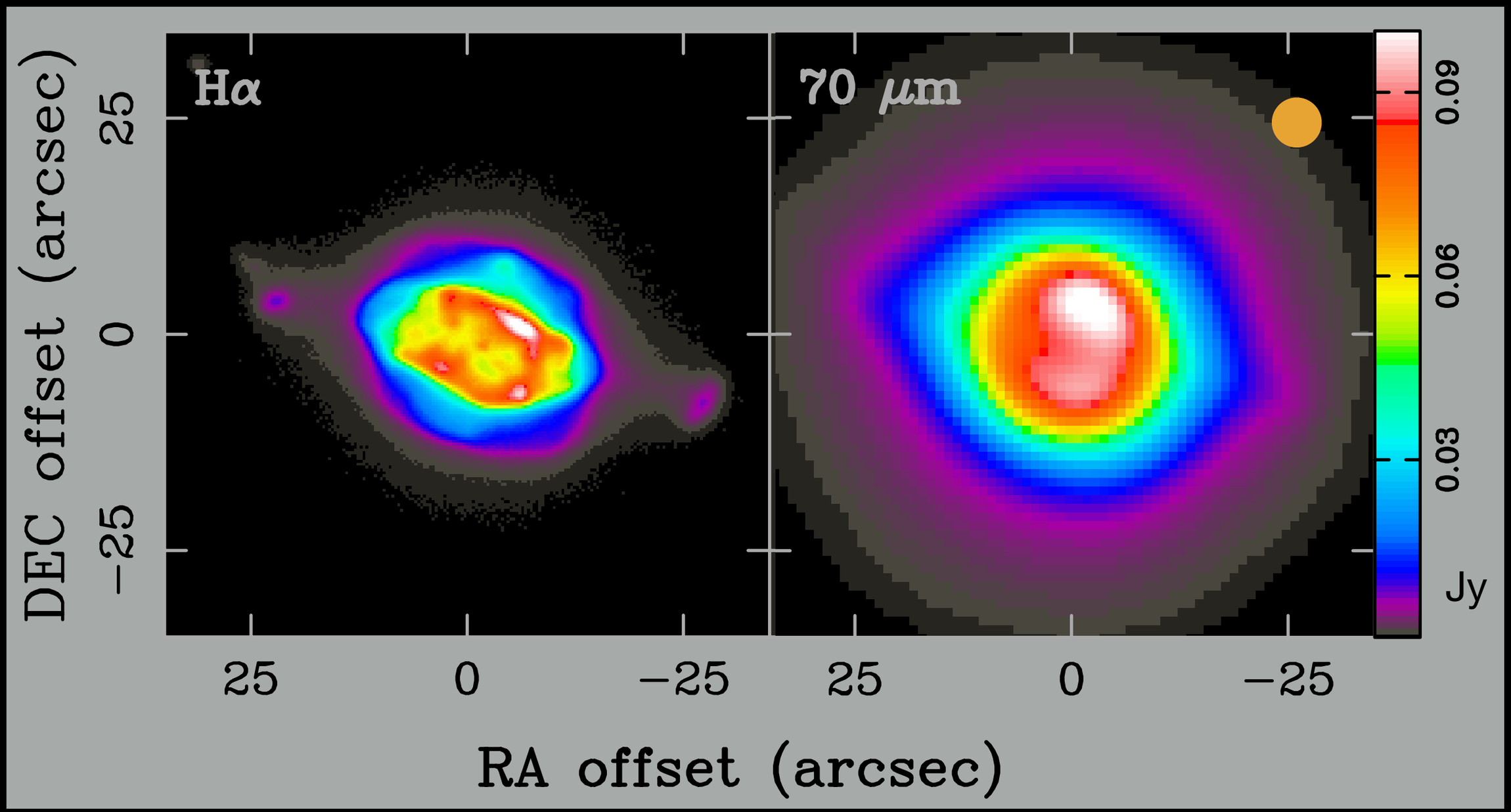
NGC 40


Hα
70 μm
Jy
0.02
0.01
0
DEC offset (arcsec)
25
0
−25
25
0
−25
25
0
−25
RA offset (arcsec)

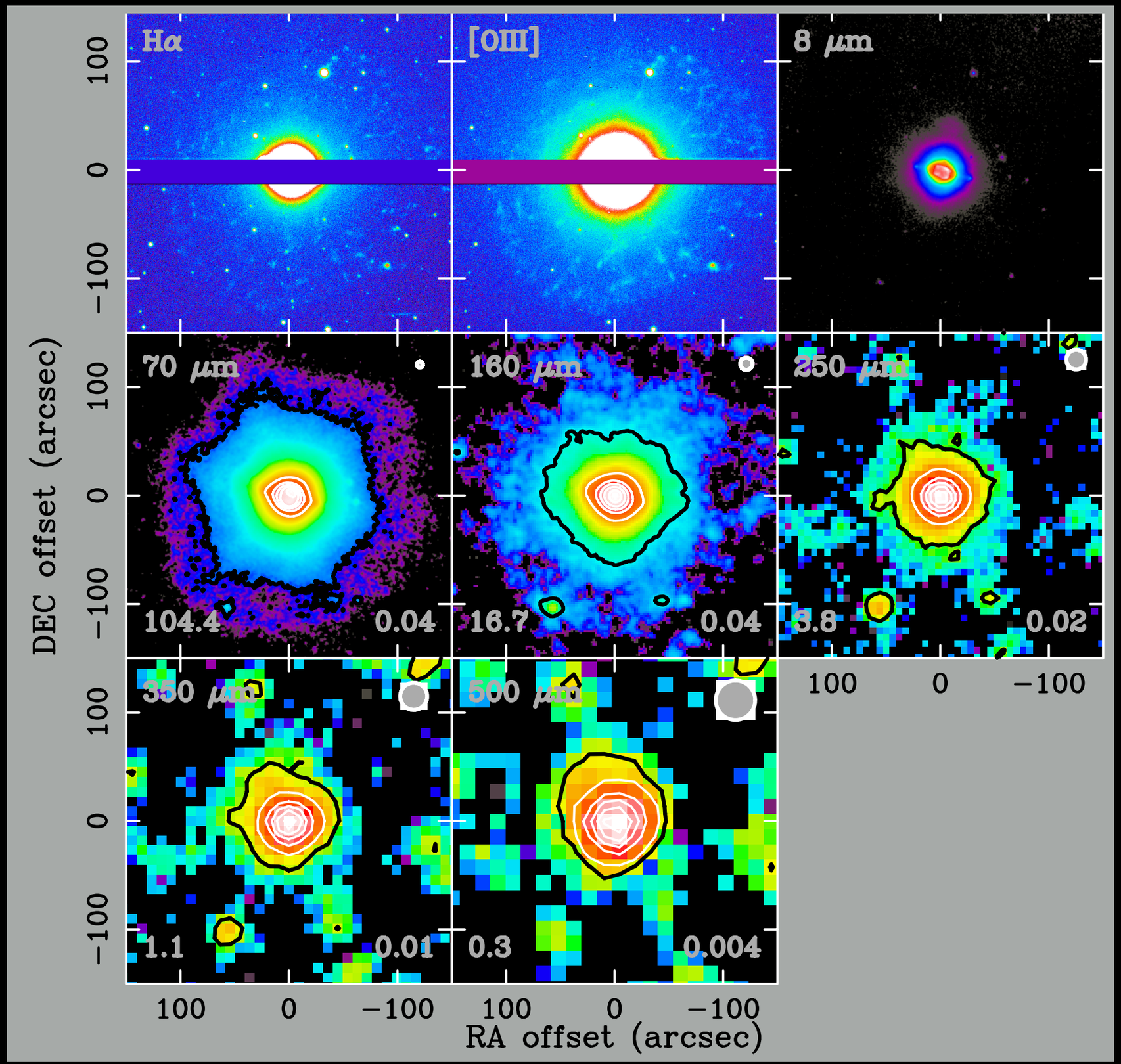
NGC 40


Hα
8 μm
70 μm
30.6
0.03
160 μm
5.9
0.02
250 μm
1.2
0.03
350 μm
0.4
0.01
500 μm
0.2
0.02
100
0
−100
DEC offset (arcsec)
RA offset (arcsec)

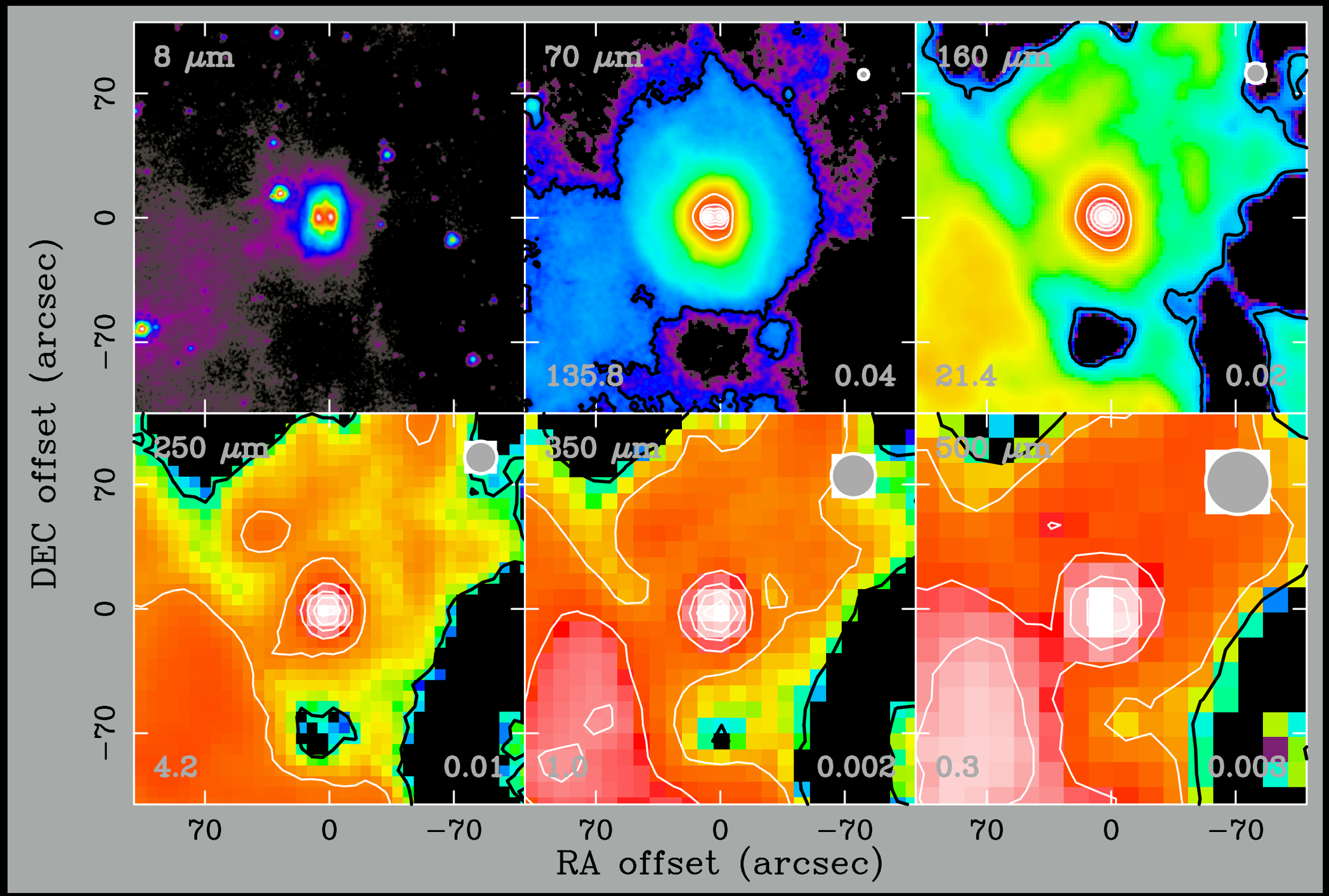
NGC 7009


Hα
70 μm
DEC offset (arcsec)
25
0
−25
25
0
−25
25
0
−25
RA offset (arcsec)
0.09
0.06
0.03
Jy

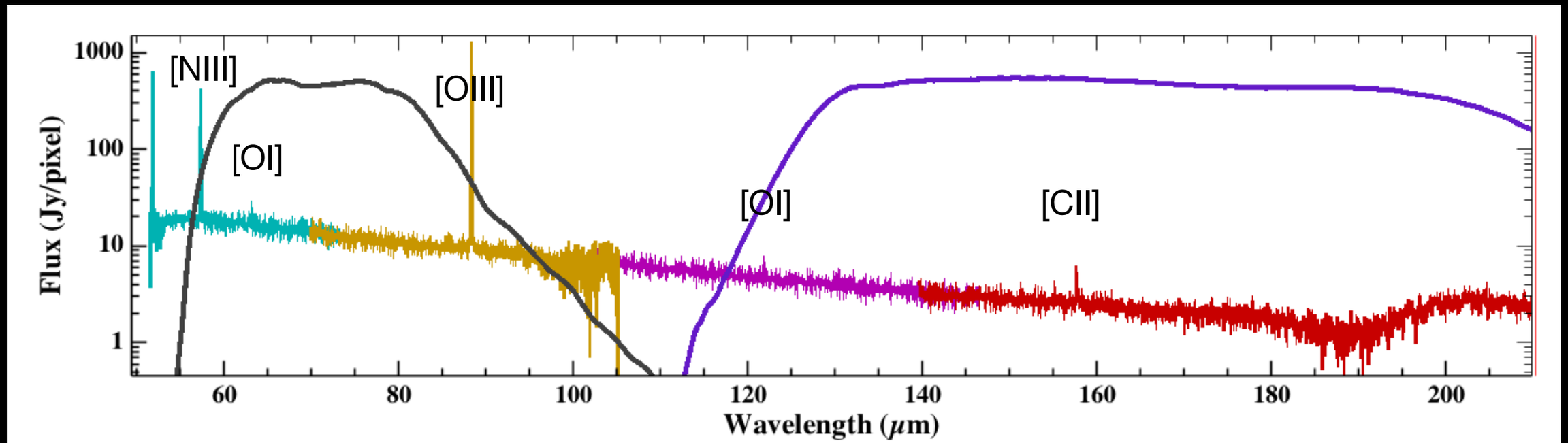
NGC 7009


Hα
[OIII]
8 μm
70 μm
160 μm
250 μm
350 μm
500 μm
104.4
0.04
16.7
0.04
3.8
0.02
1.1
0.01
0.3
0.004
100
0
−100
DEC offset (arcsec)
RA offset (arcsec)

NGC 7026


8 μm
70 μm
160 μm
135.8
0.04
21.4
0.02
250 μm
350 μm
500 μm
4.2
0.01
1.0
0.002
0.3
0.003
70
0
−70
DEC offset (arcsec)
RA offset (arcsec)

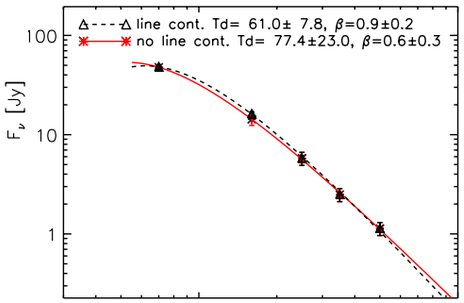
What lines are contaminating the photometry?



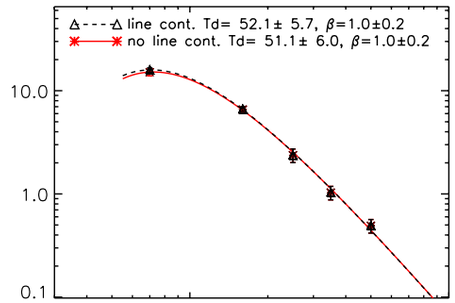
PACS spectrum VS broadband transmission curves

Aperture photometry and averaged dust temperature

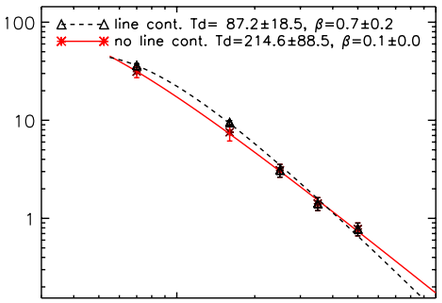
Average dust temperature



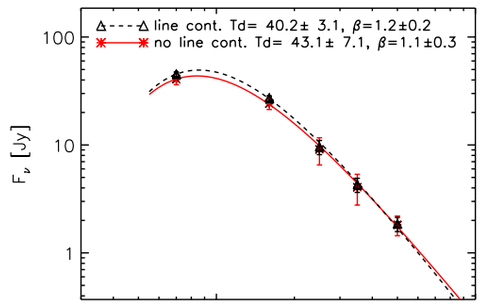
(a) NGC 40



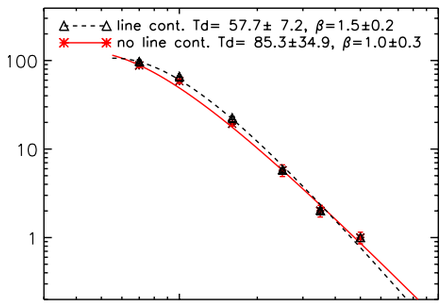
(b) NGC 2392



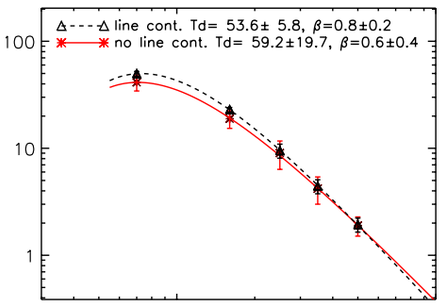
(c) NGC 3242



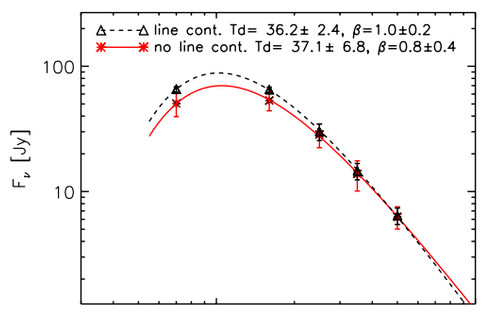
(d) NGC 6445



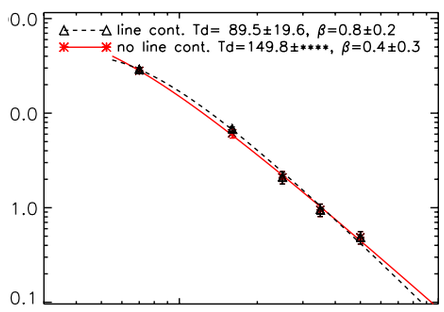
(e) NGC 6543



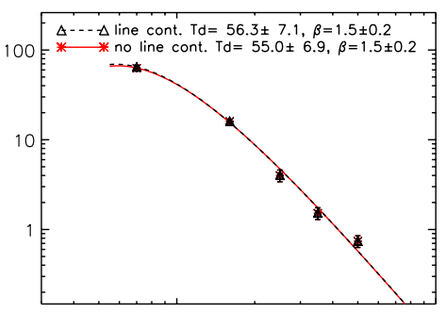
(f) NGC 6720



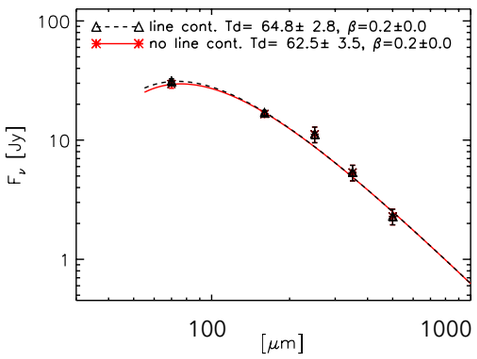
(g) NGC 6781



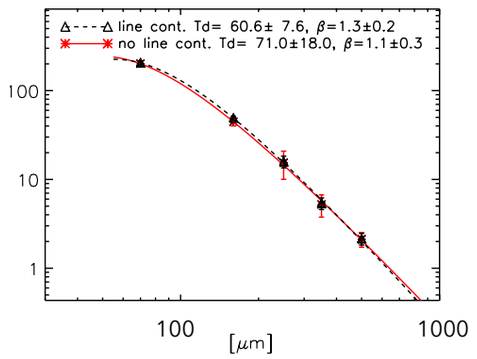
(h) NGC 6826



(i) NGC 7009

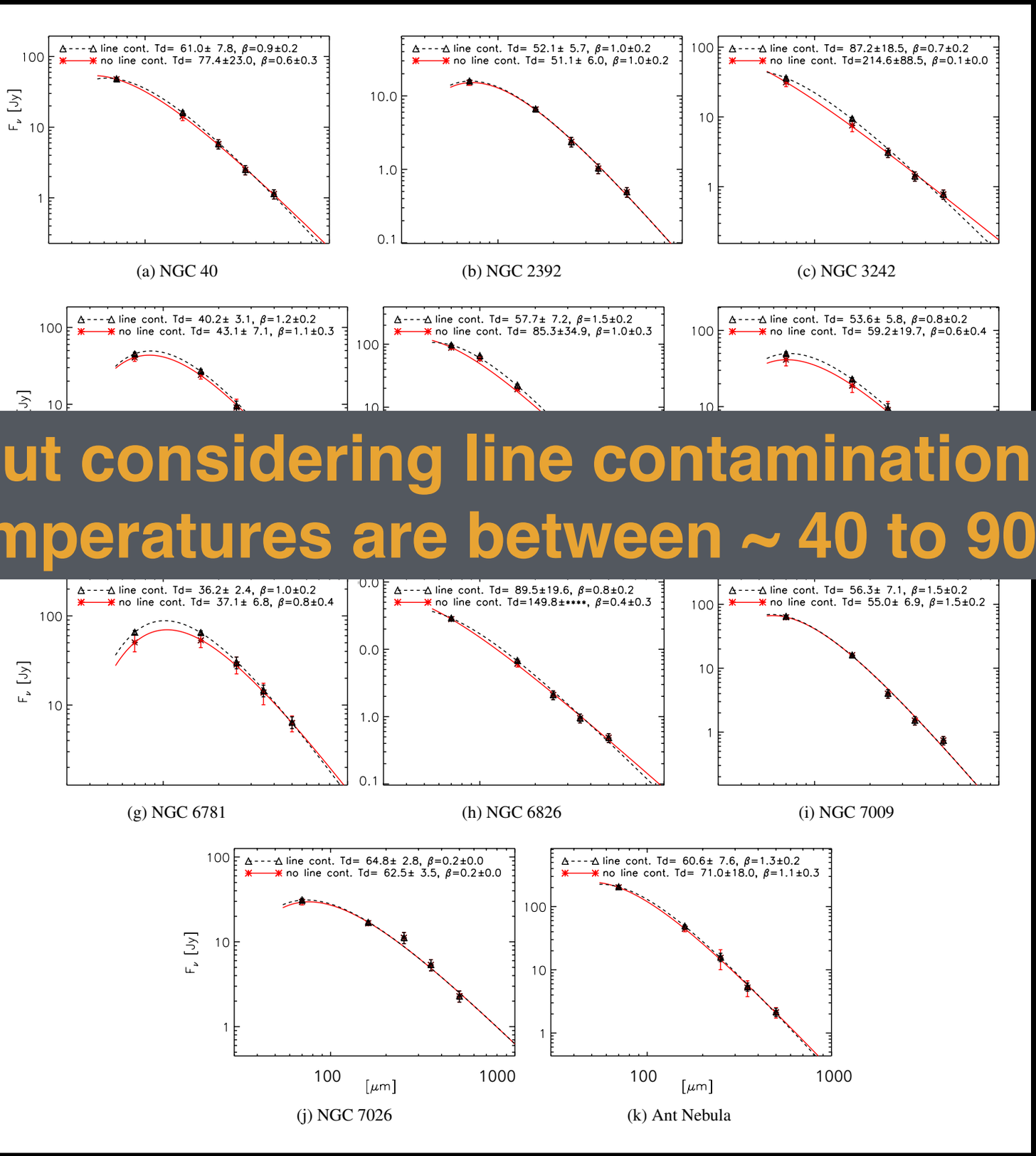


(j) NGC 7026



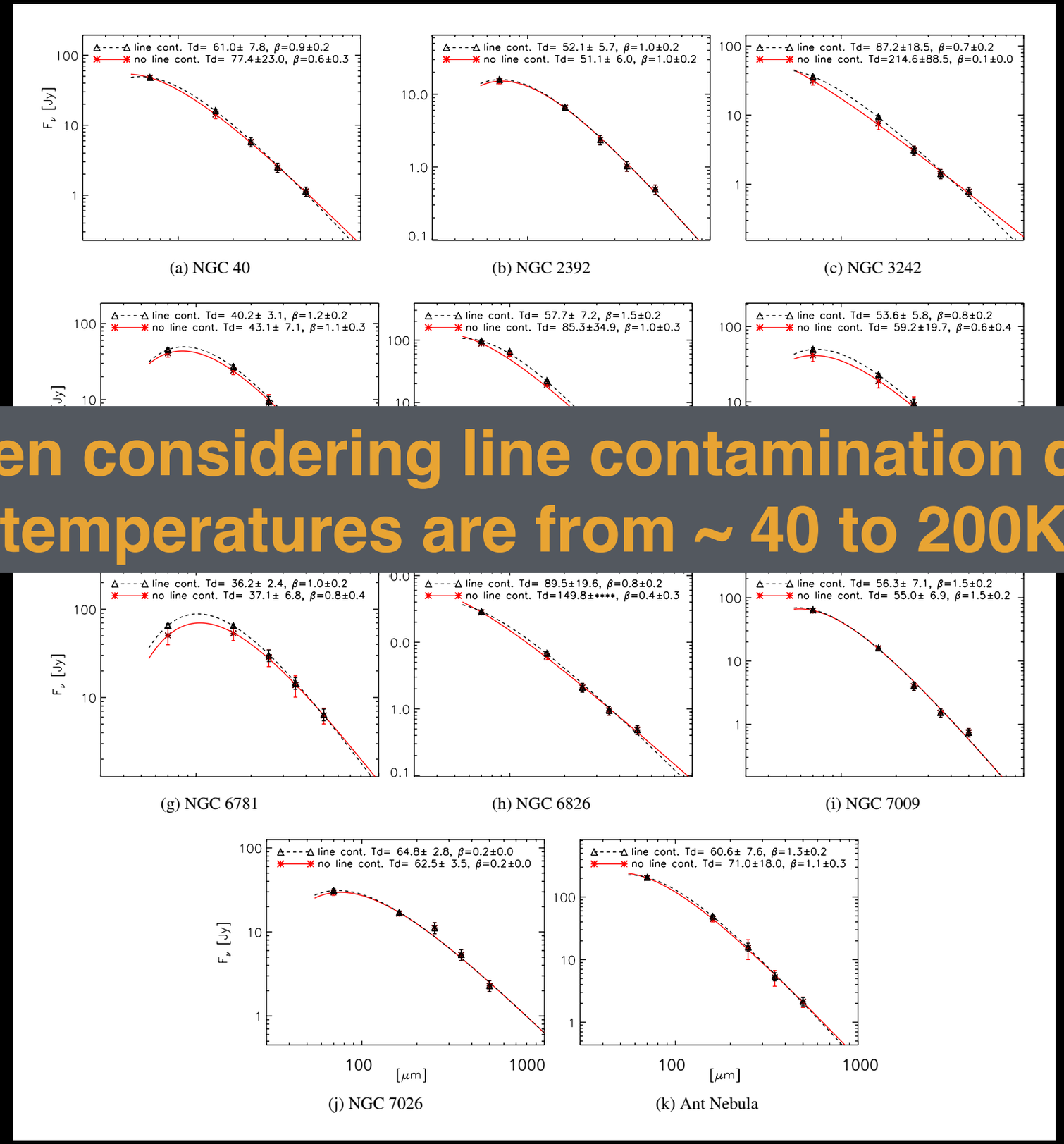
(k) Ant Nebula

Average dust temperature



Without considering line contamination dust temperatures are between ~ 40 to 90K

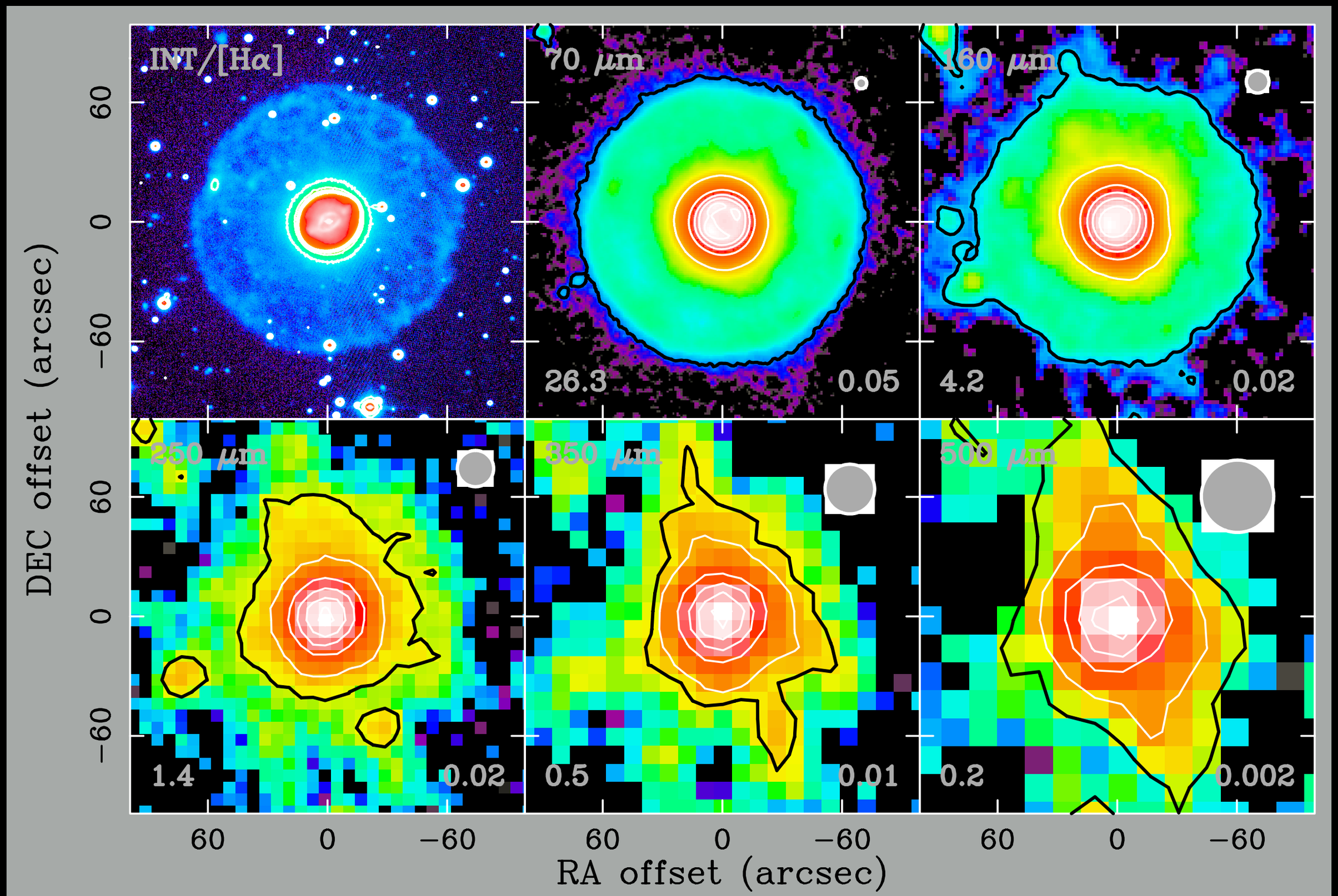
Average dust temperature



When considering line contamination dust temperatures are from ~ 40 to 200K

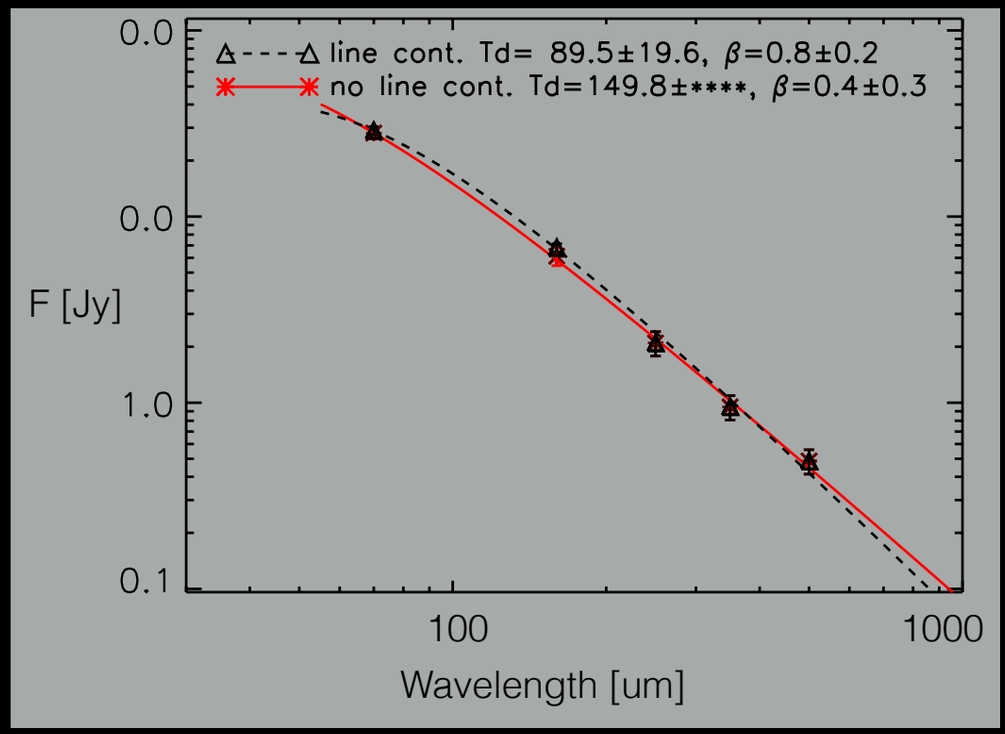
Dust temperature maps or how spatial resolution matters

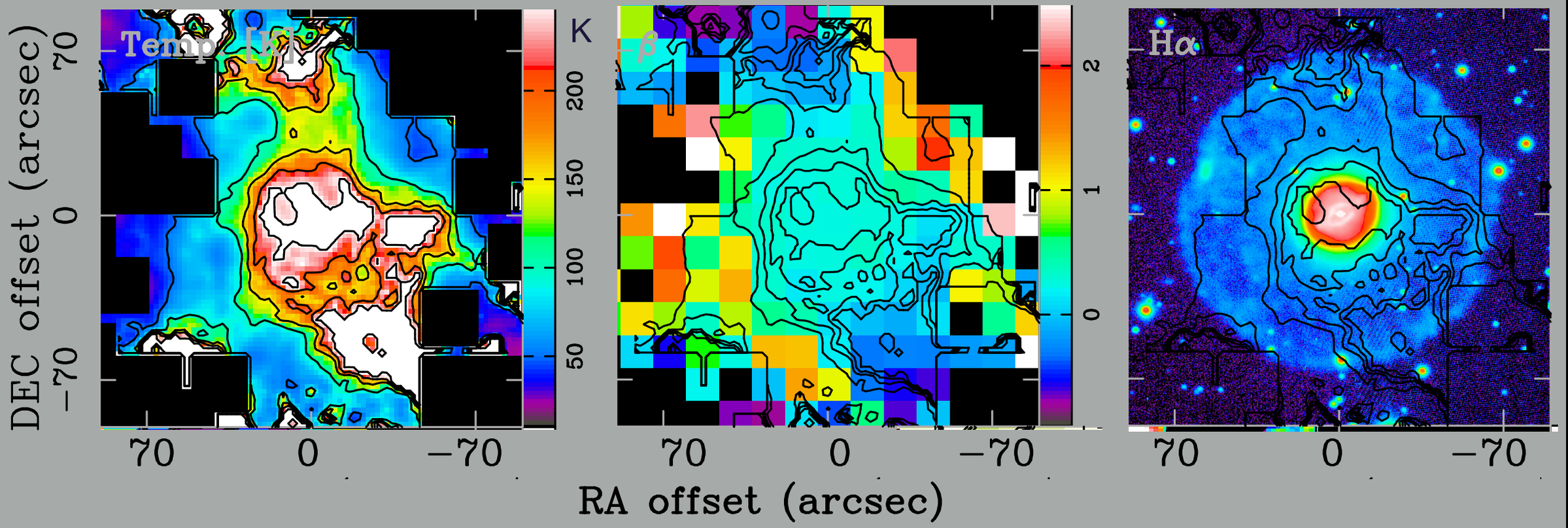
NGC 6826


INT/[Hα]
70 μm
160 μm
26.3
0.05
4.2
0.02
250 μm
350 μm
500 μm
1.4
0.02
0.5
0.01
0.2
0.002
60
0
−60
DEC offset (arcsec)
RA offset (arcsec)

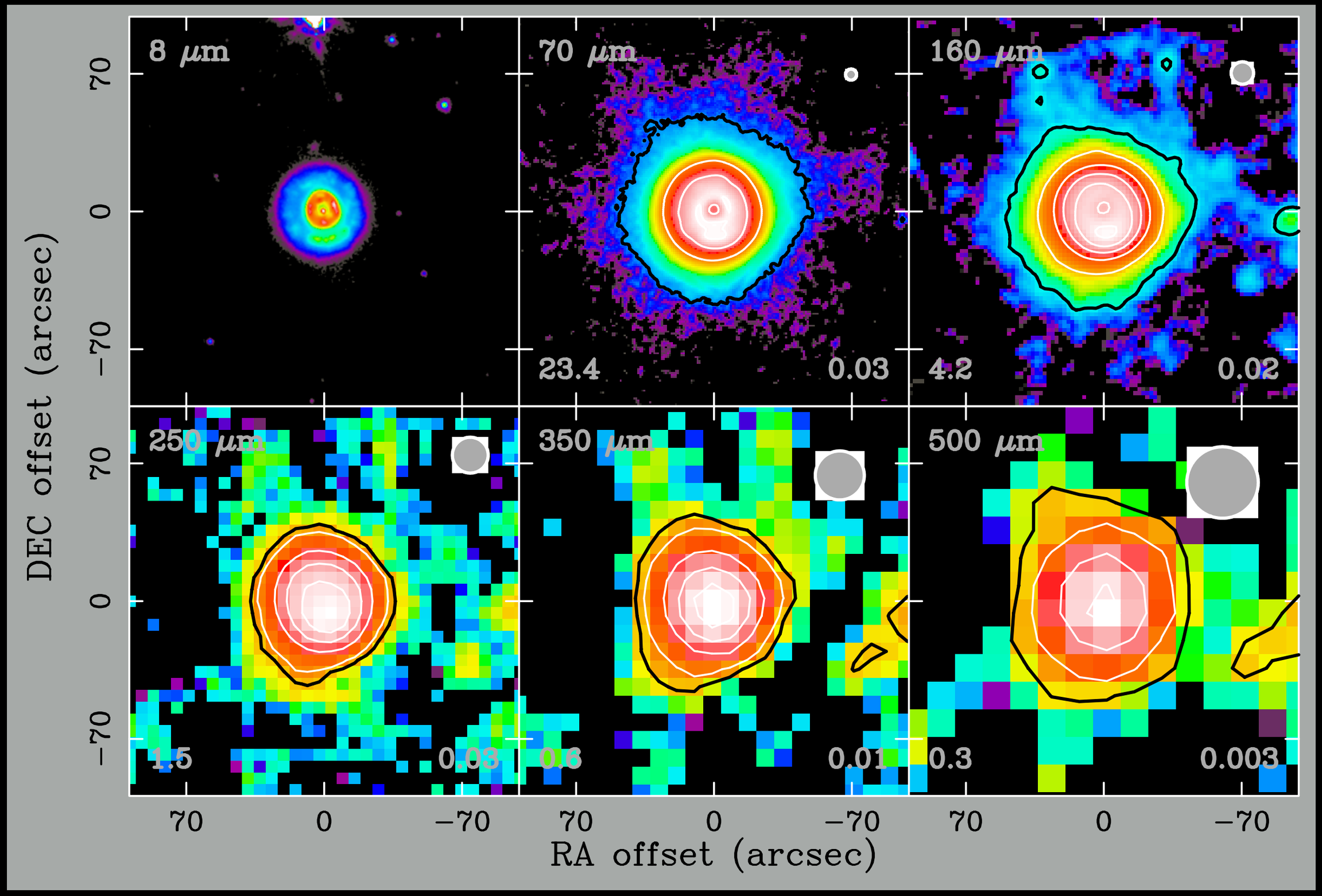
NGC 6826

Averaged dust temperature of ~ 140K



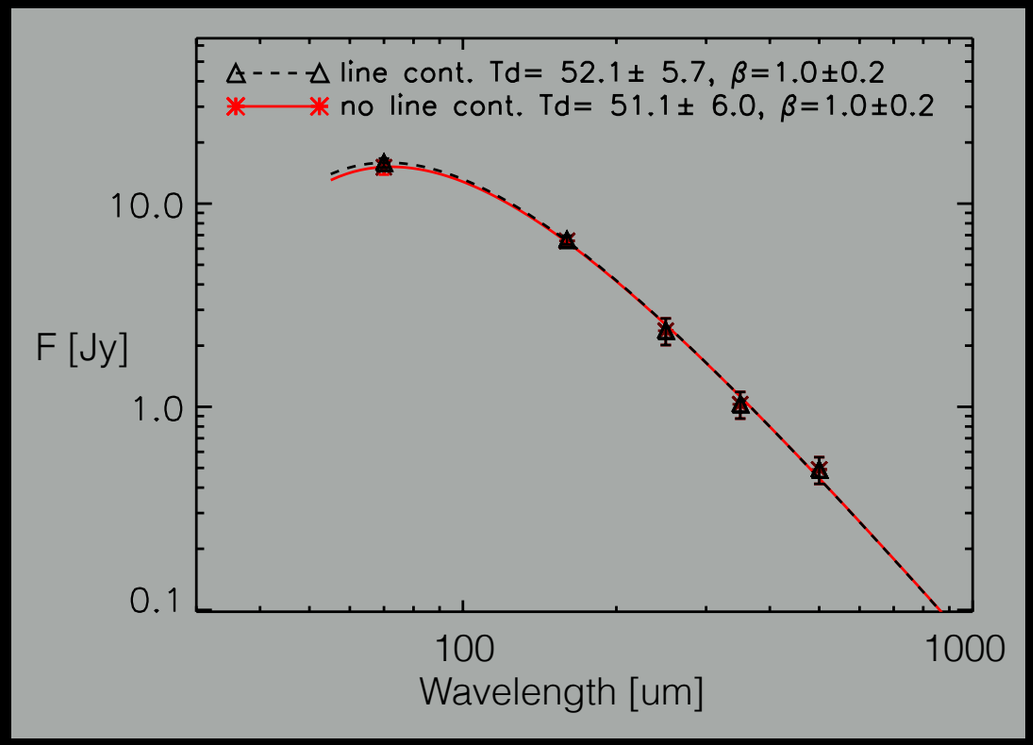


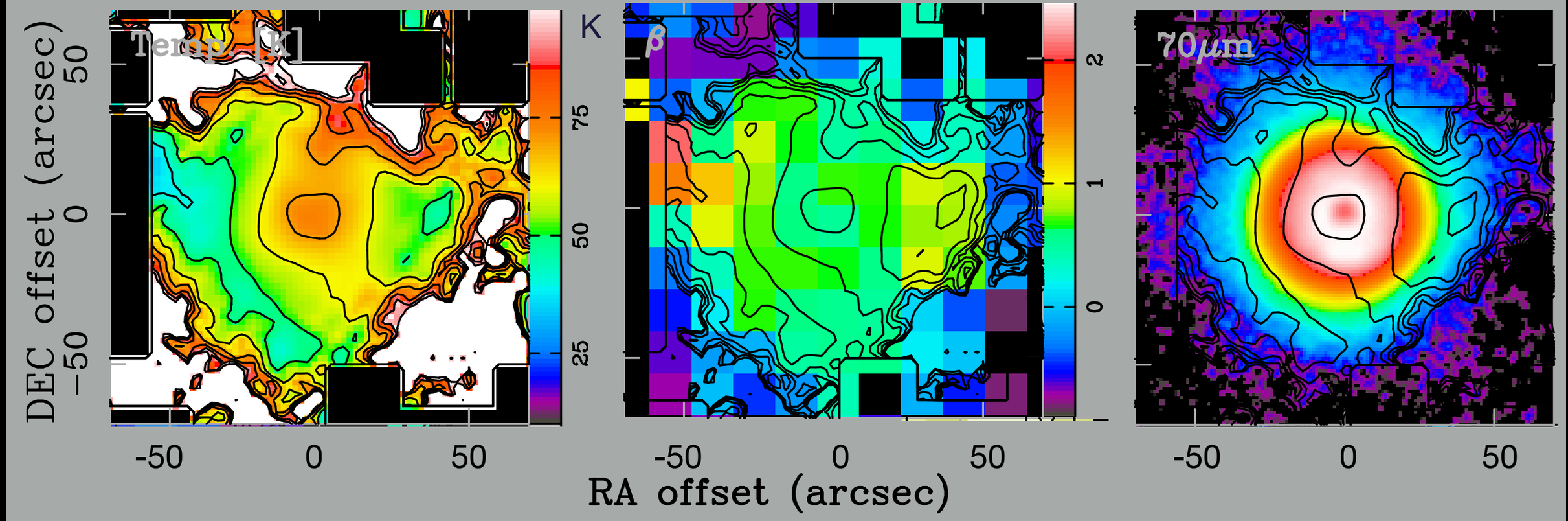
NGC 2392


8 μm
70 μm
160 μm
23.4
0.03
4.2
0.02
250 μm
350 μm
500 μm
1.5
0.03
0.6
0.01
0.3
0.003
DEC offset (arcsec)
RA offset (arcsec)
70
0
−70

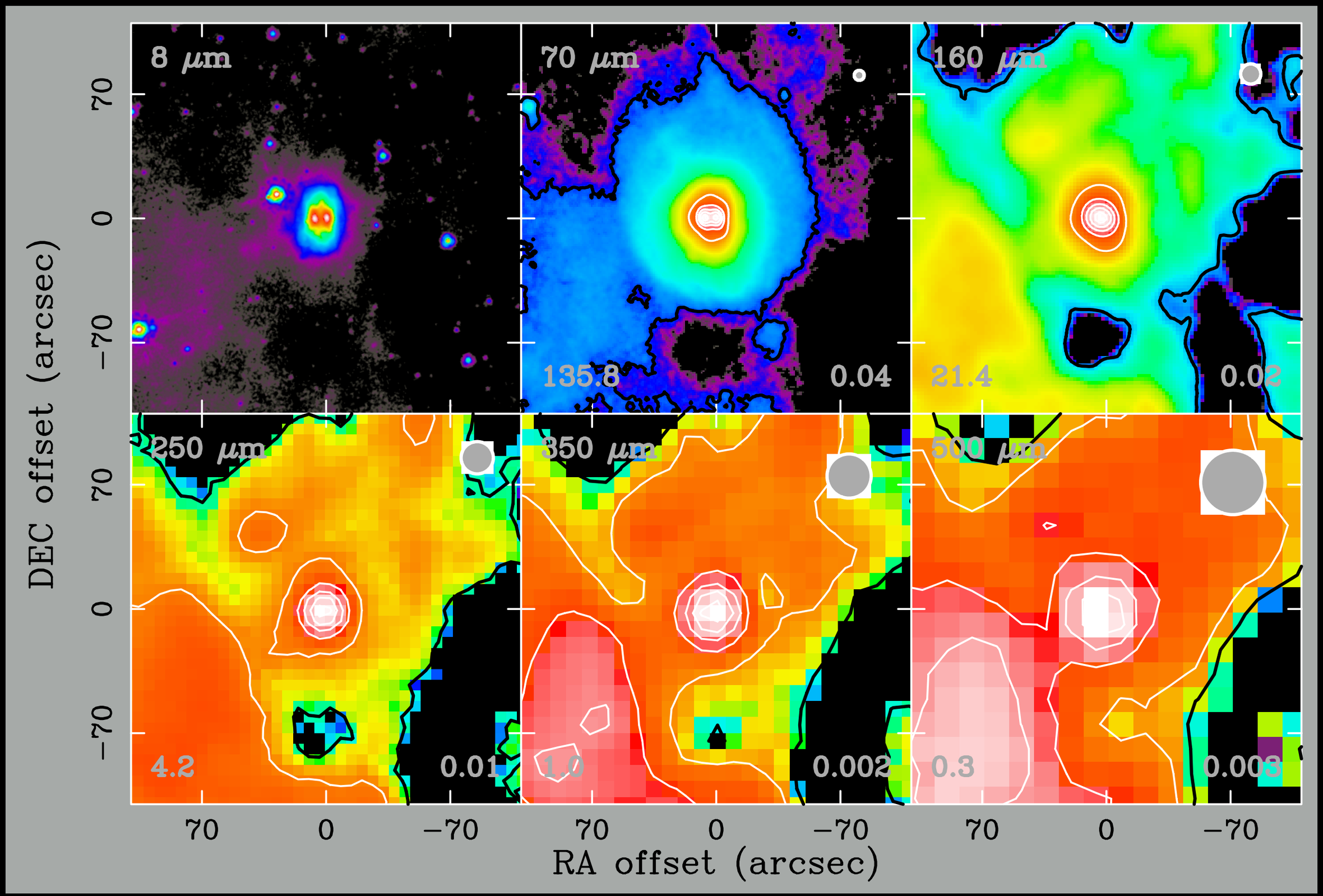
NGC 2392

Averaged dust temperature of ~ 50K



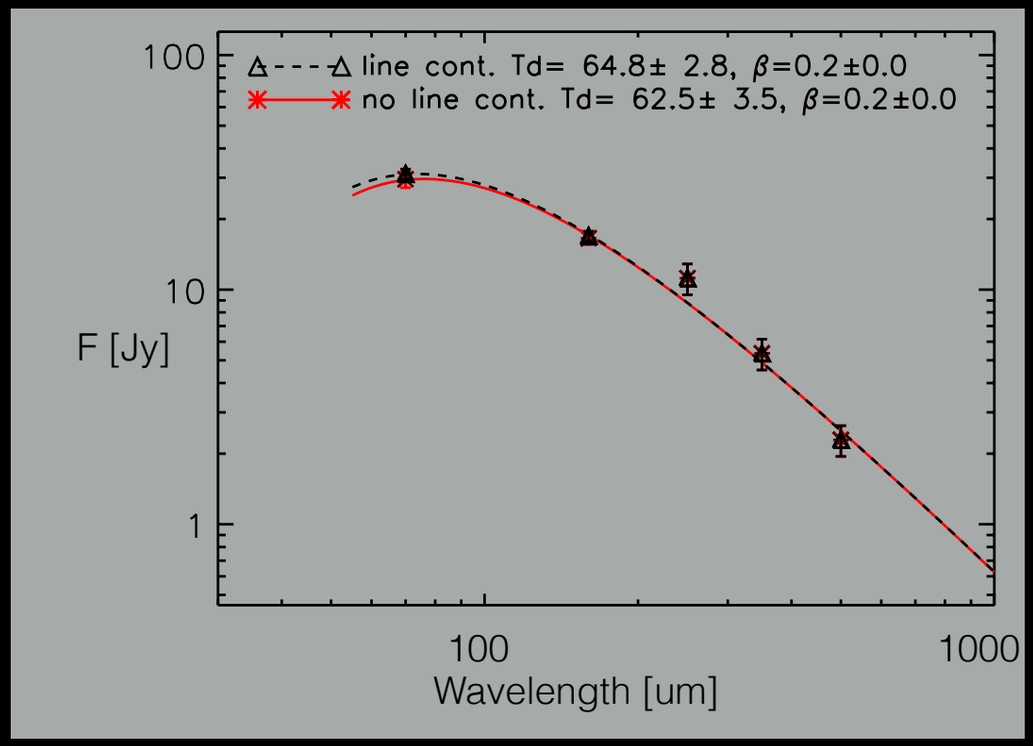


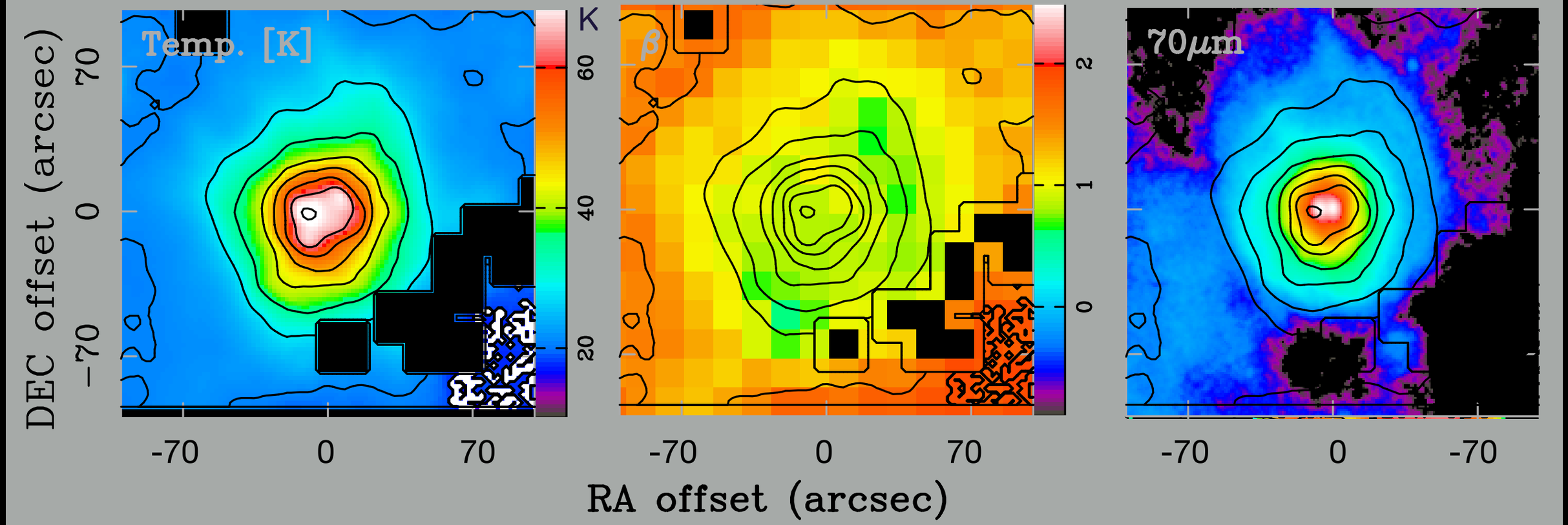
NGC 7026


8 μm
70 μm
160 μm
135.8
0.04
21.4
0.02
250 μm
350 μm
500 μm
4.2
0.01
1.0
0.002
0.3
0.003
70
0
−70
DEC offset (arcsec)
RA offset (arcsec)

NGC 7026

Averaged dust temperature of ~ 65K



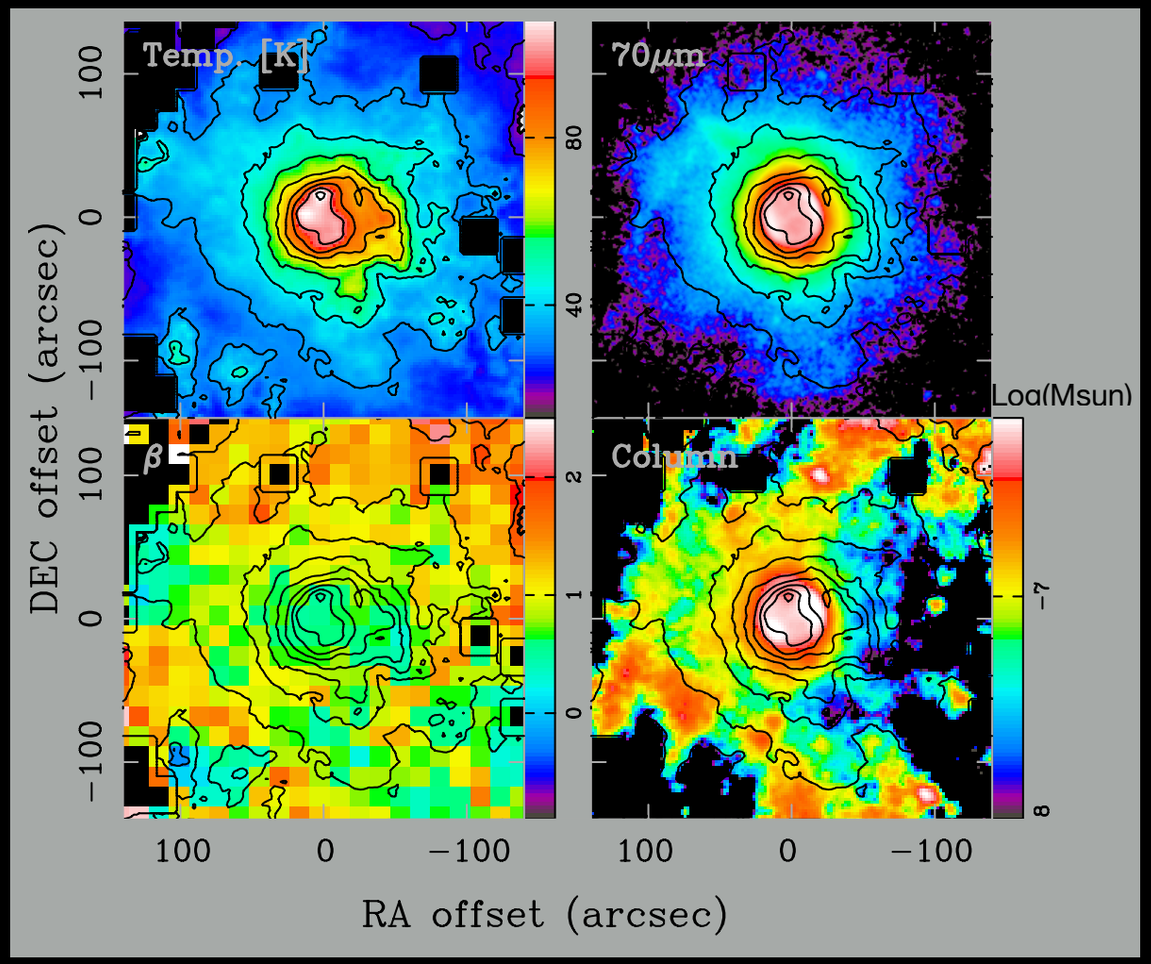


What next?

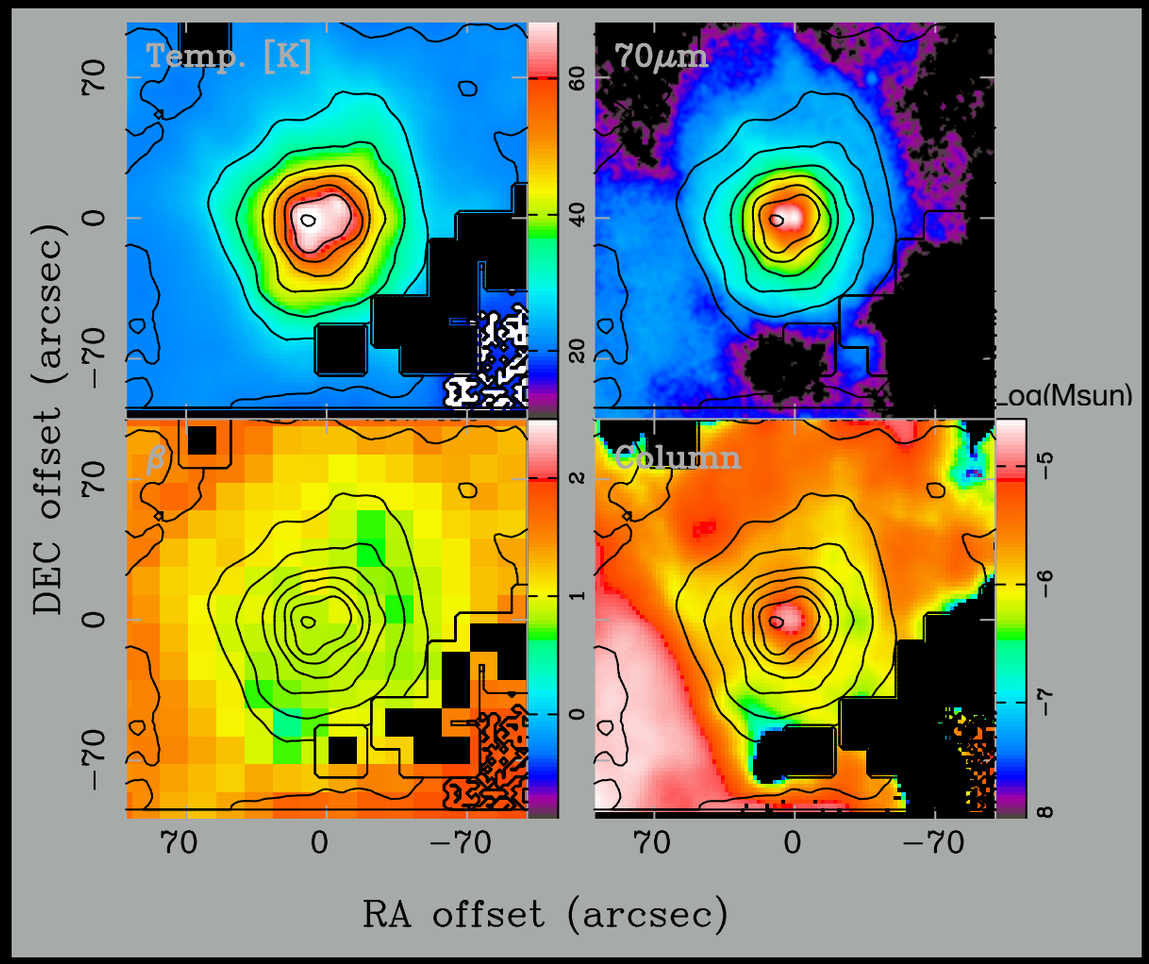
NGC 40

NGC 7026

Near future: dust mass

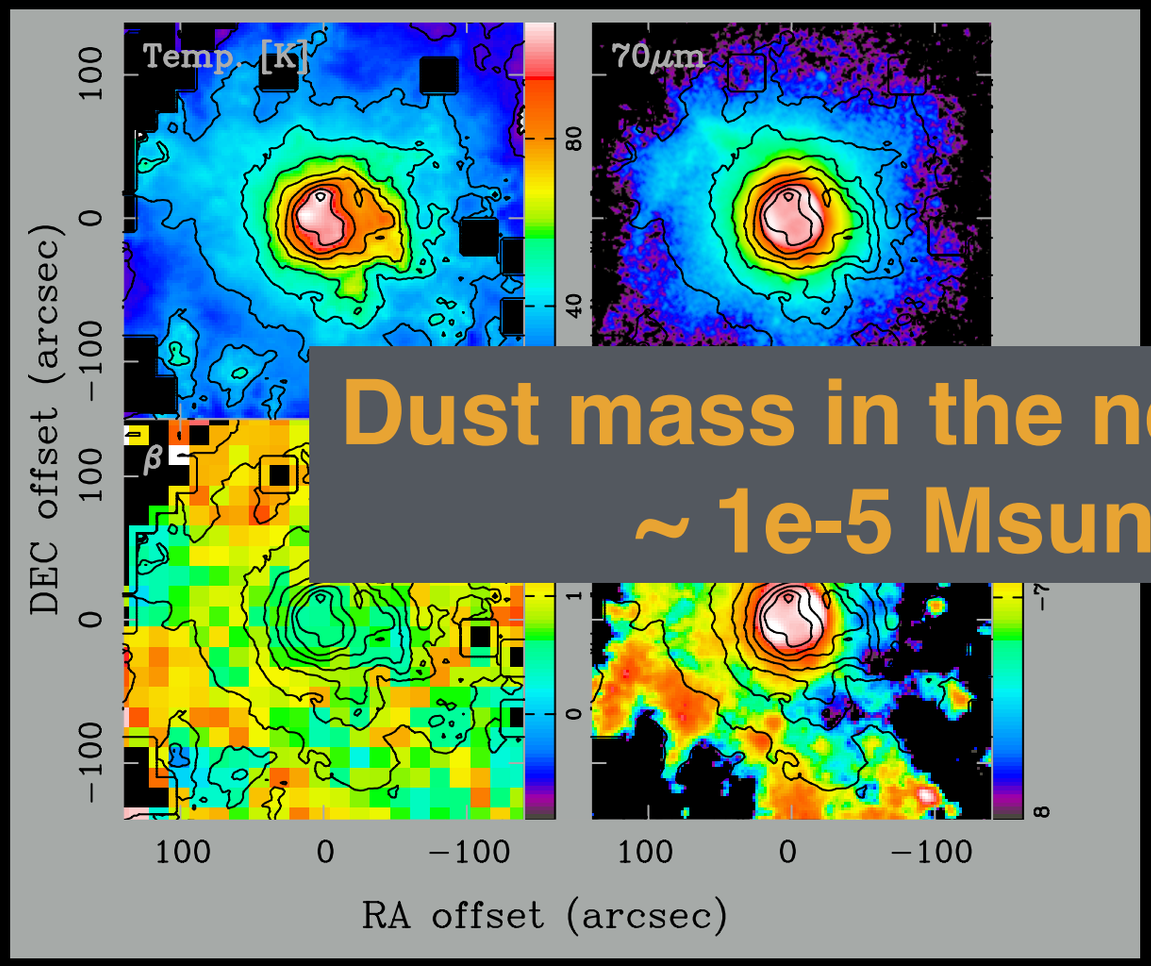


NGC 40

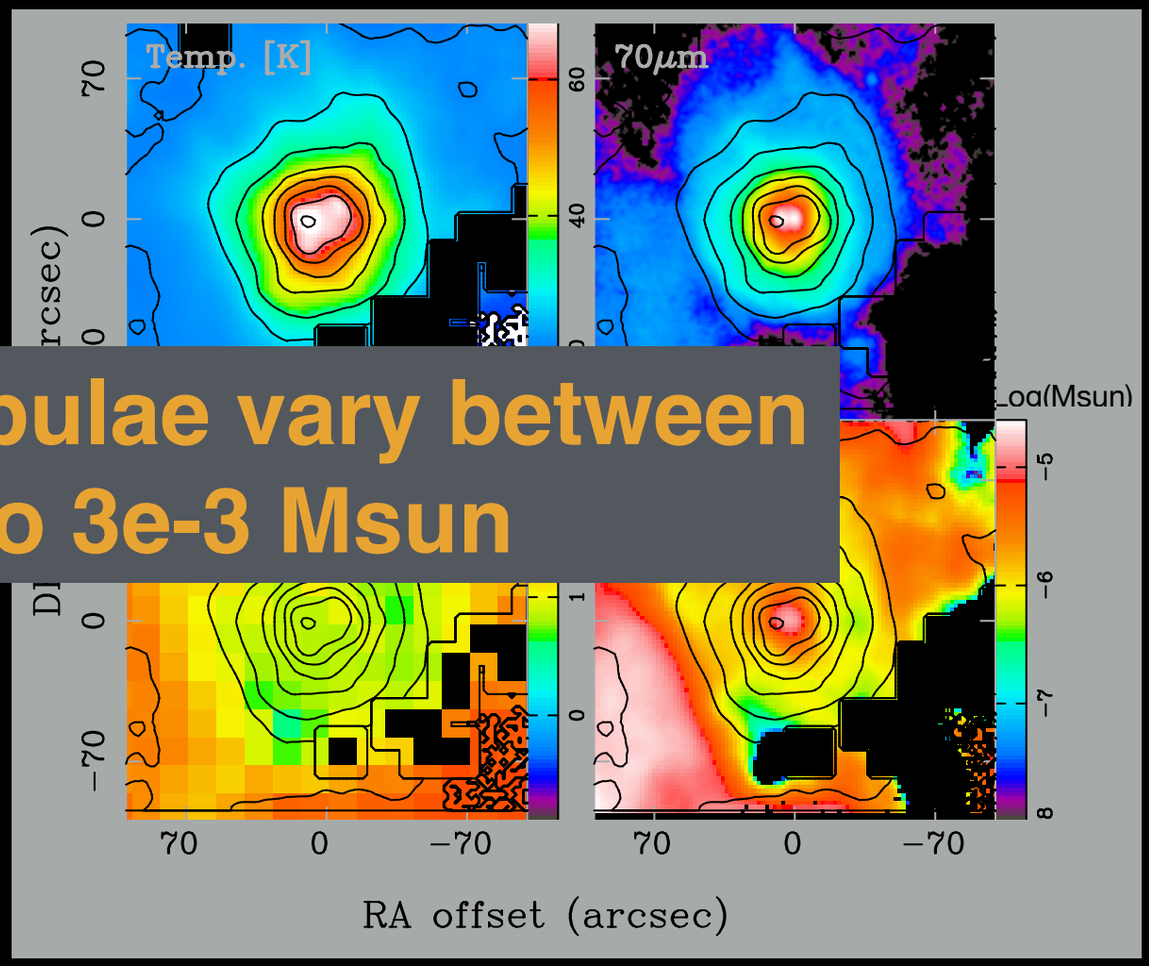


NGC 7026

Near future: dust mass



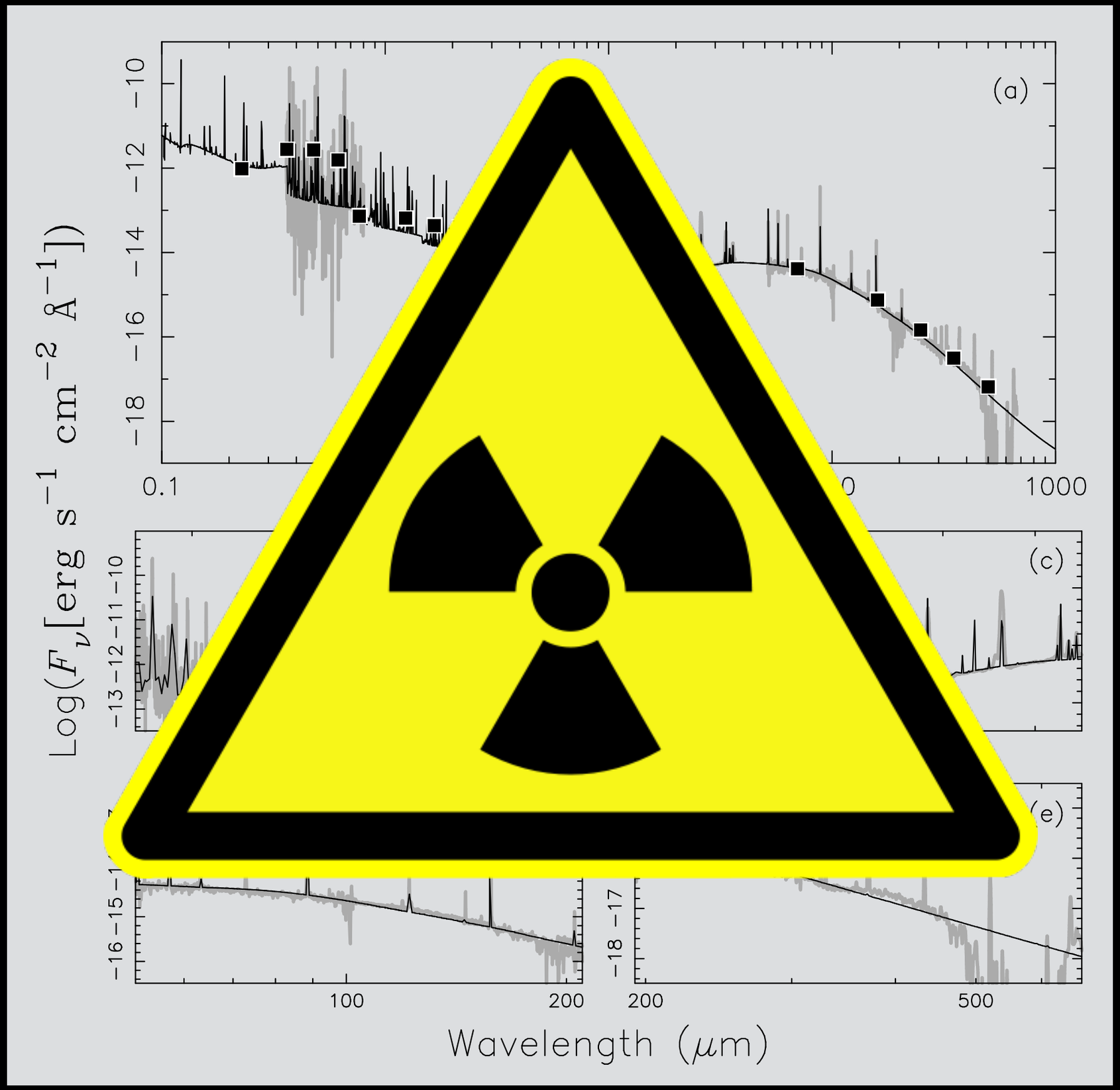
NGC 40



NGC 7026

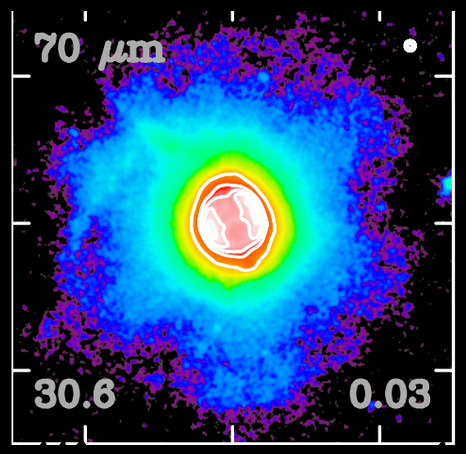
Dust mass in the nebulae vary between ~ 1e-5 Msun to 3e-3 Msun

More challenges

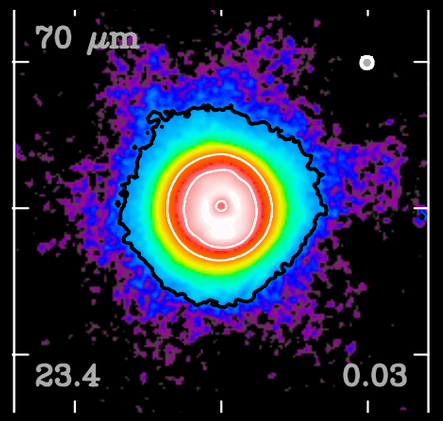


All HerPlaNS 70um maps

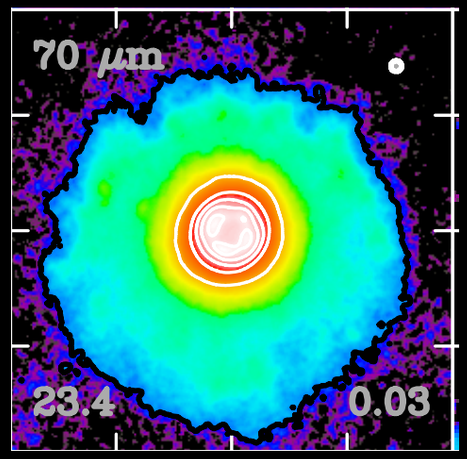
NGC 40



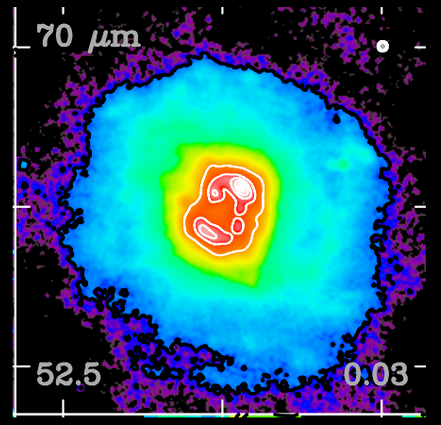
NGC 2392



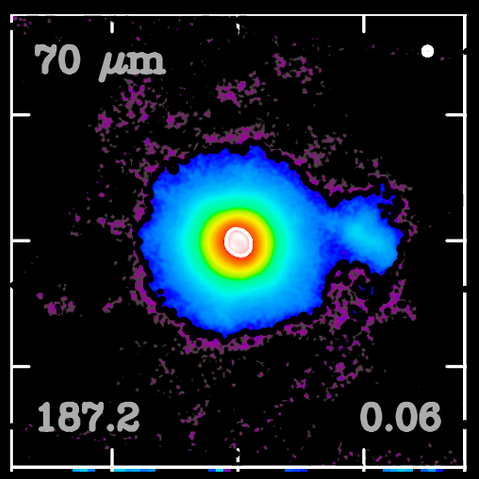
NGC 3242



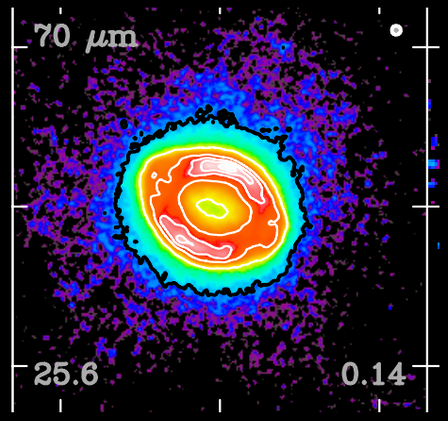
NGC 6445



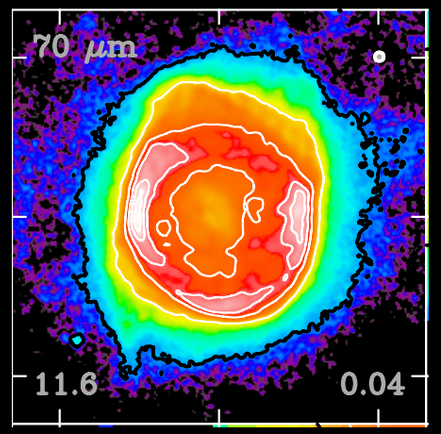
NGC 6543



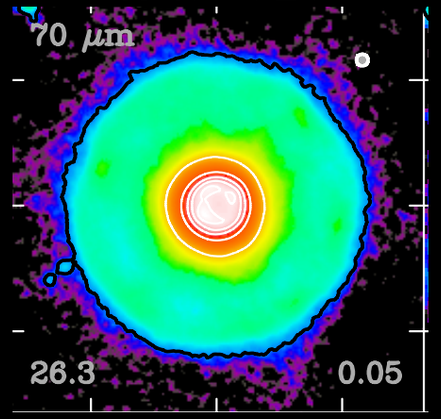
NGC 6720



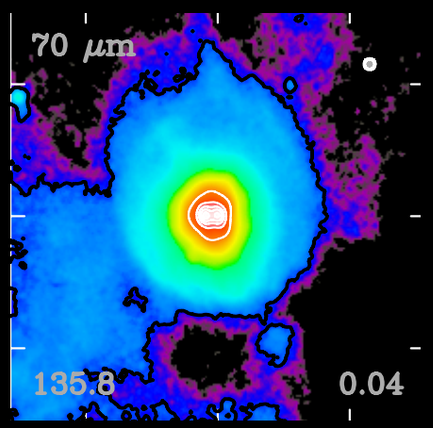
NGC 6781



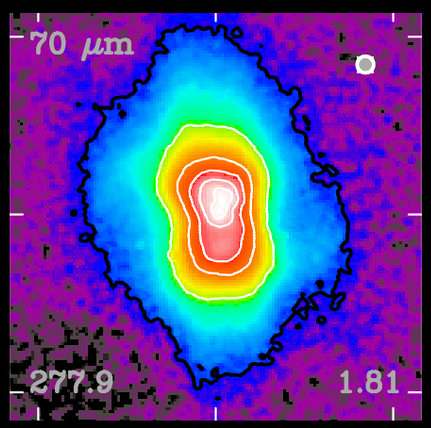
NGC 6826



NGC 7026



Ant Nebula



NGC 7009