Circumnuclear Disk in NGC 5128 (Centaurus A)

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Huge Radio Source

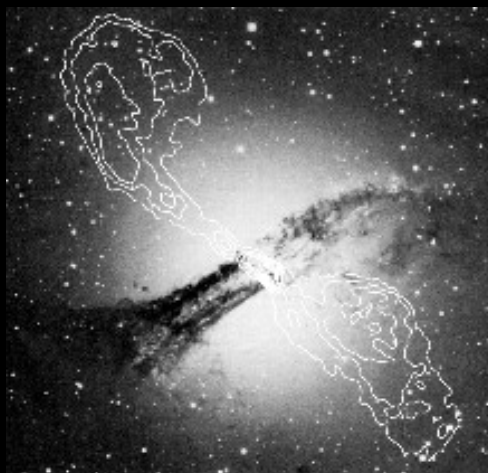
image: Cen A & Moon
(ATCA, Feain et al 2011)

Post-merger galaxy
Giant Elliptical Host
Nearest Radio Galaxy
Source high-energy CR

Key representative of an entire object class

Cen A Radio Jet and Inner Lobes

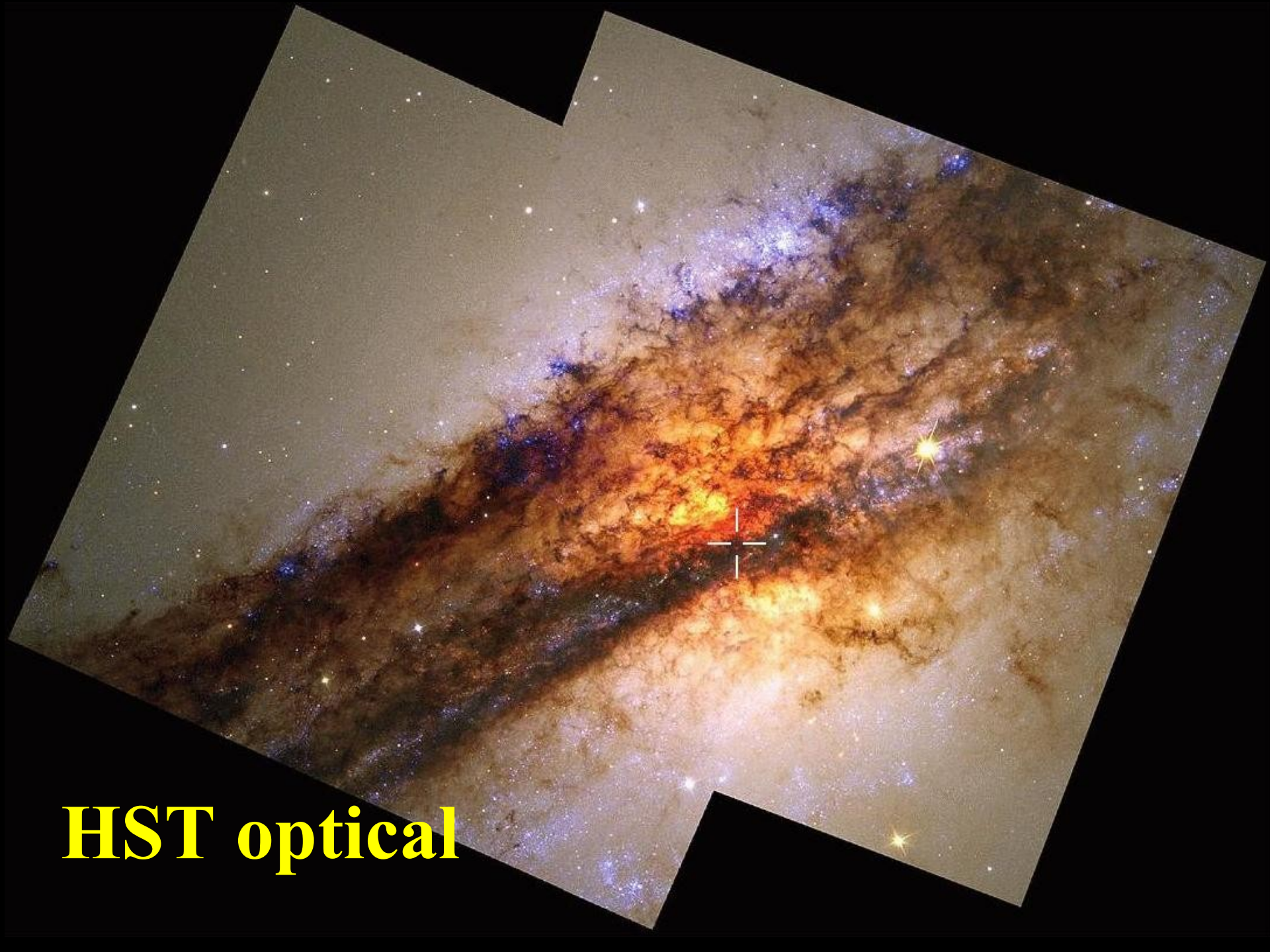
(Burns & Price, 1983, 8'x8' VLA)



Central Engine:
SMBH 5 x 10^7 M_{sun}
(Capellari et al, 2009)

How is it being fed (inflow)?
How much:
*** falls into BH?**
***is ejected in jets?**
*** is consumed by SF?**

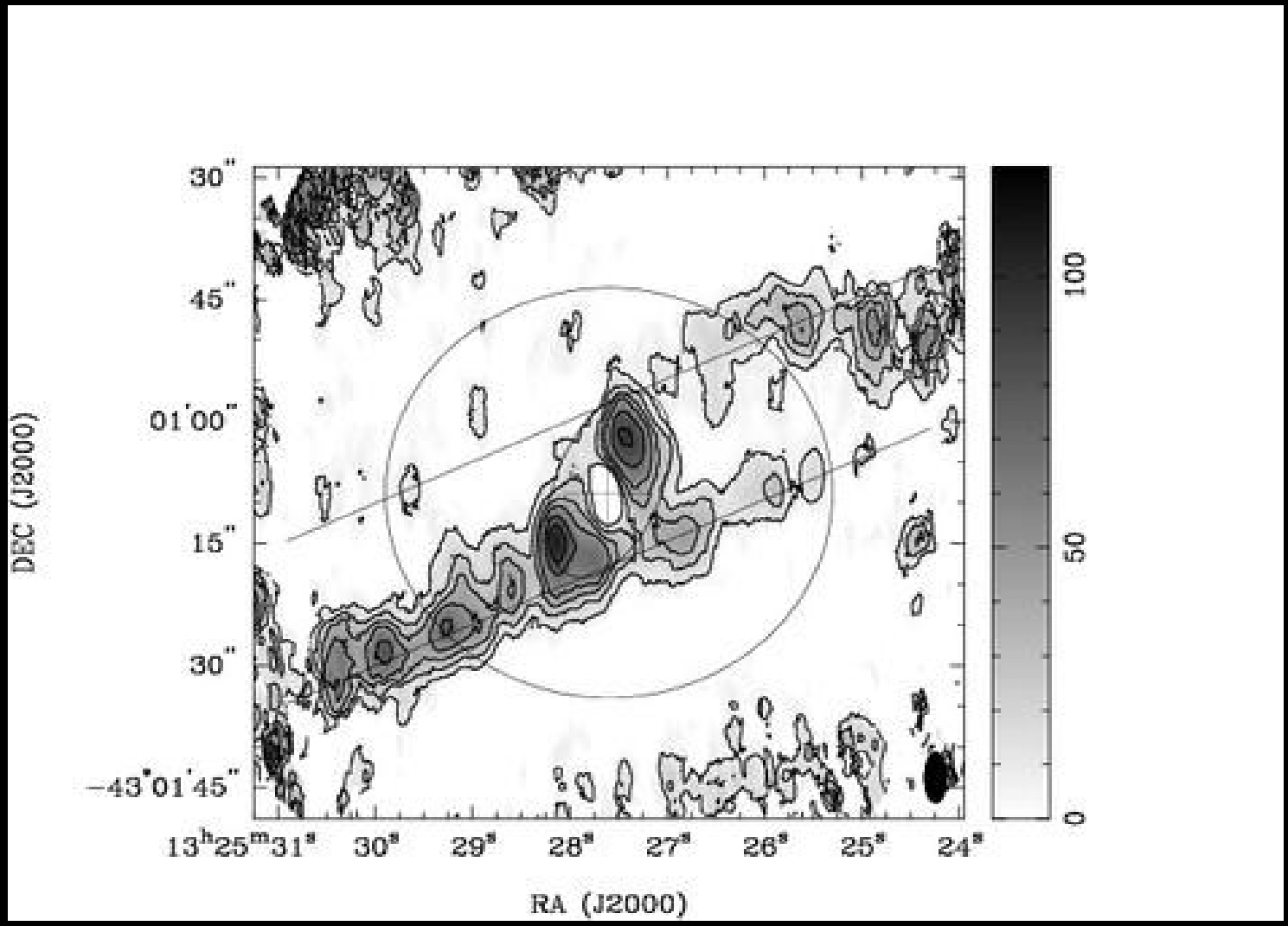
Processes in CND and Nucleus are key!


HST optical

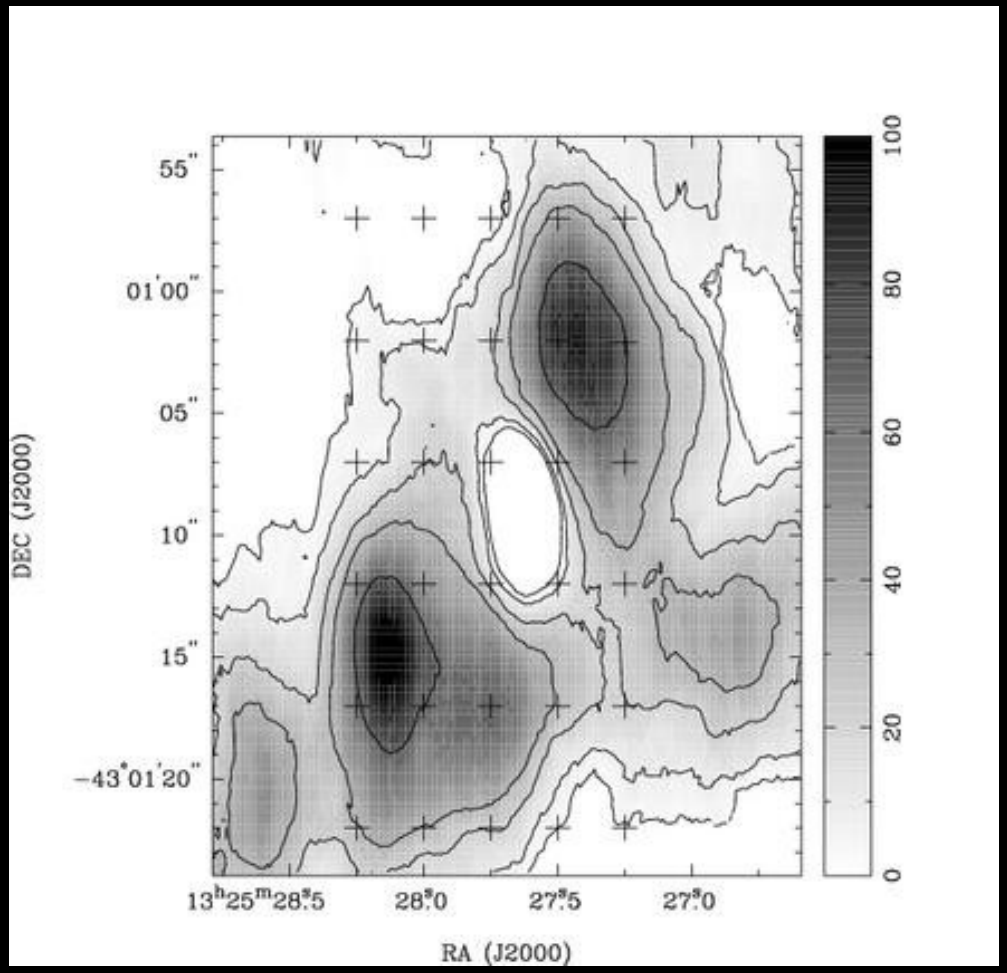
SPITZER mid-infrared

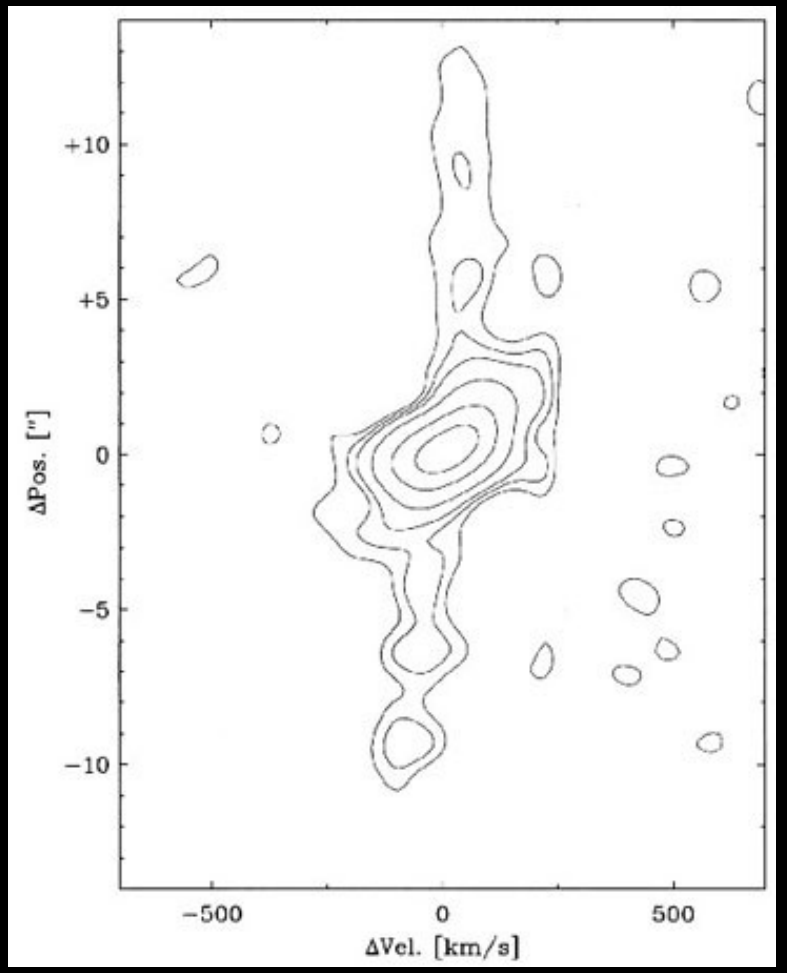
(Espada et al 2009)

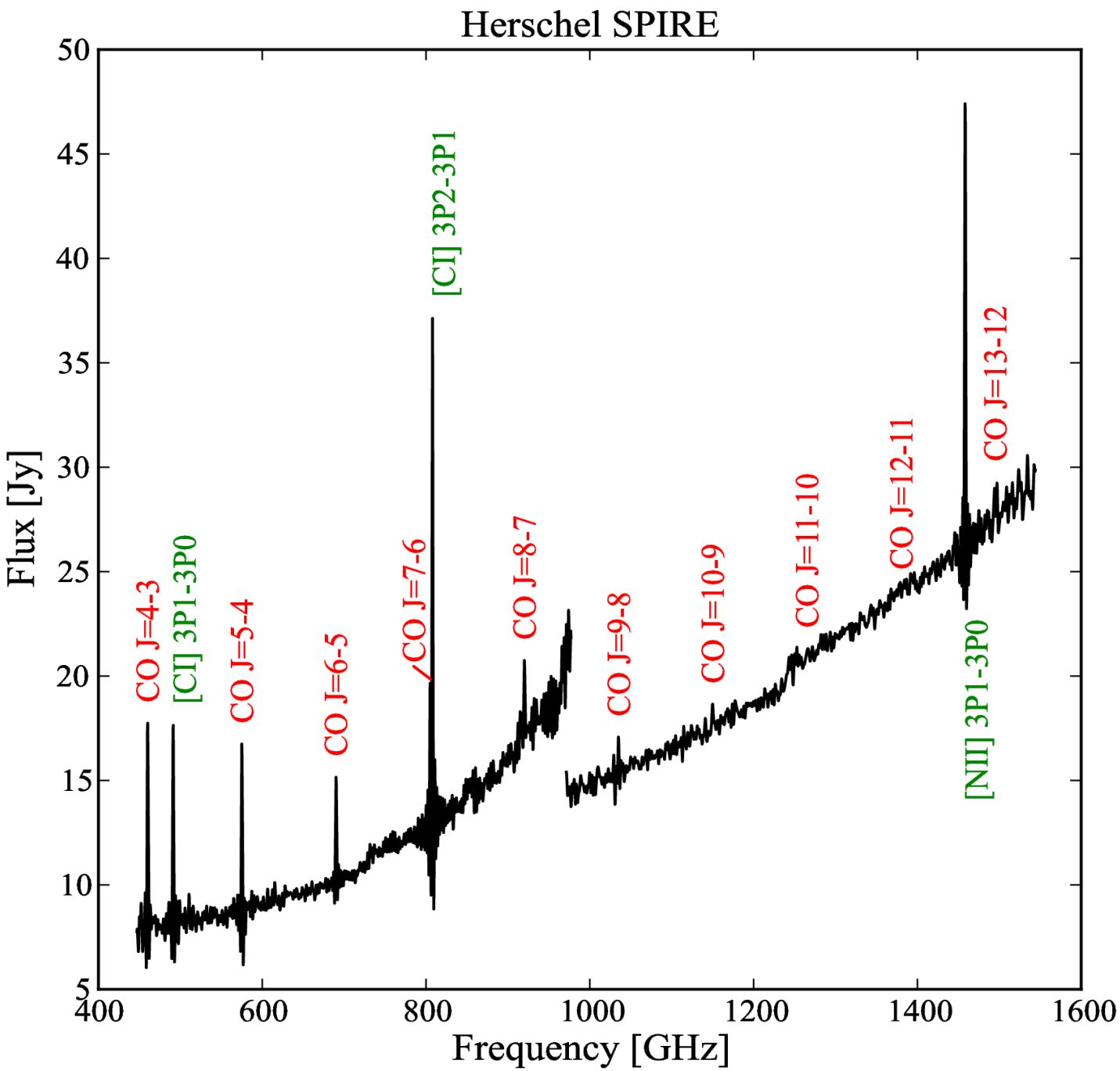
CENA 12CO(2-1) SMA



CND 400 pc diameter
central 'hole' 75 pc diameter



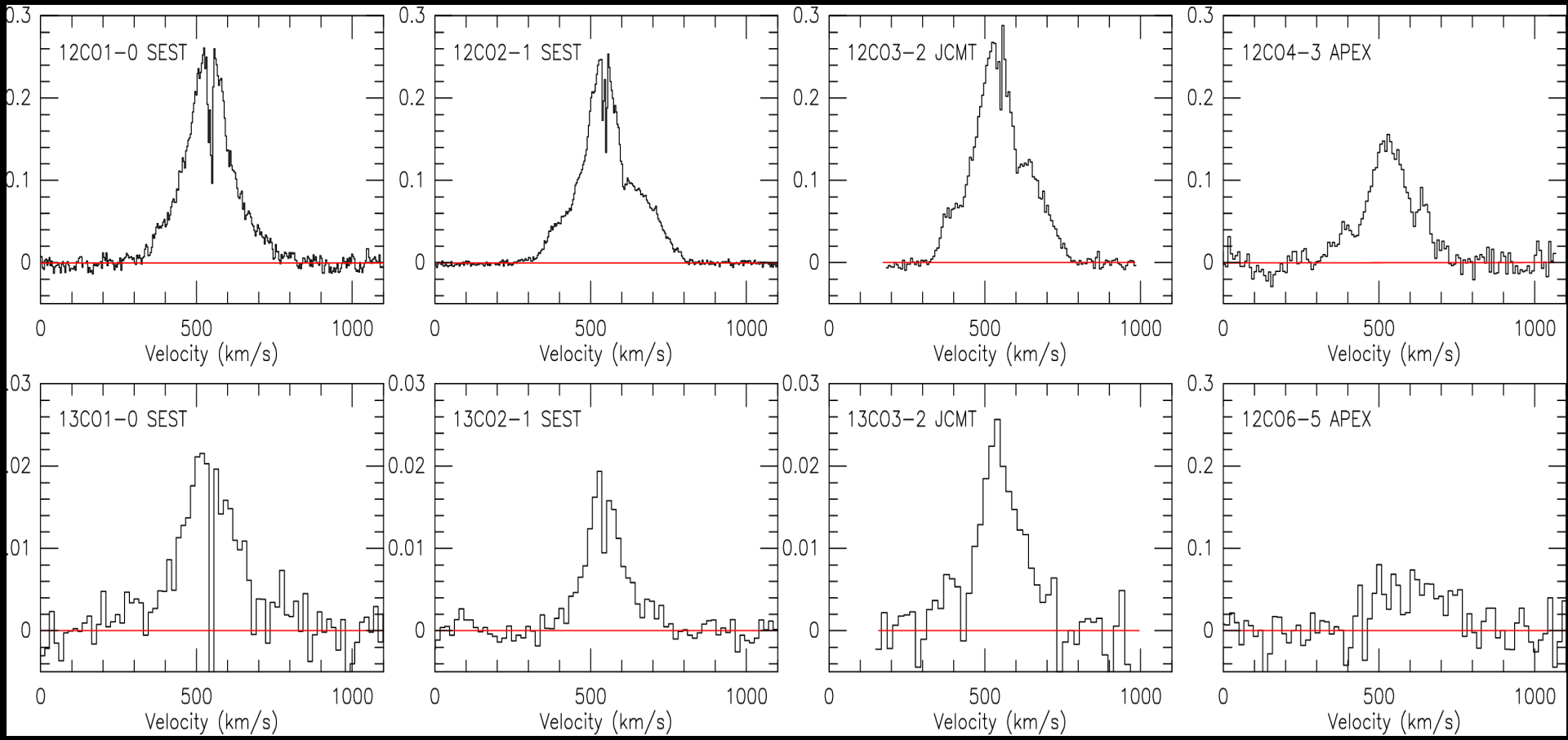




Cen A SPIRE

CO [CI]

CO lines from SEST, JCMT, APEX

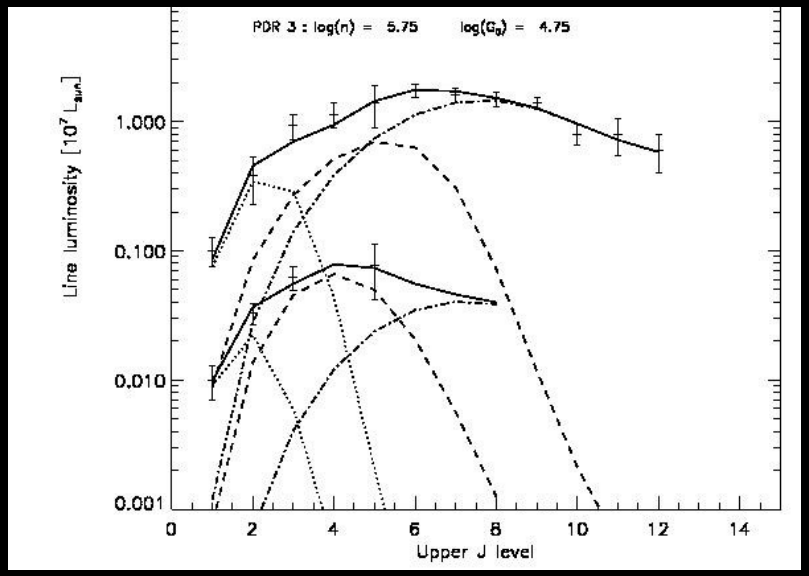


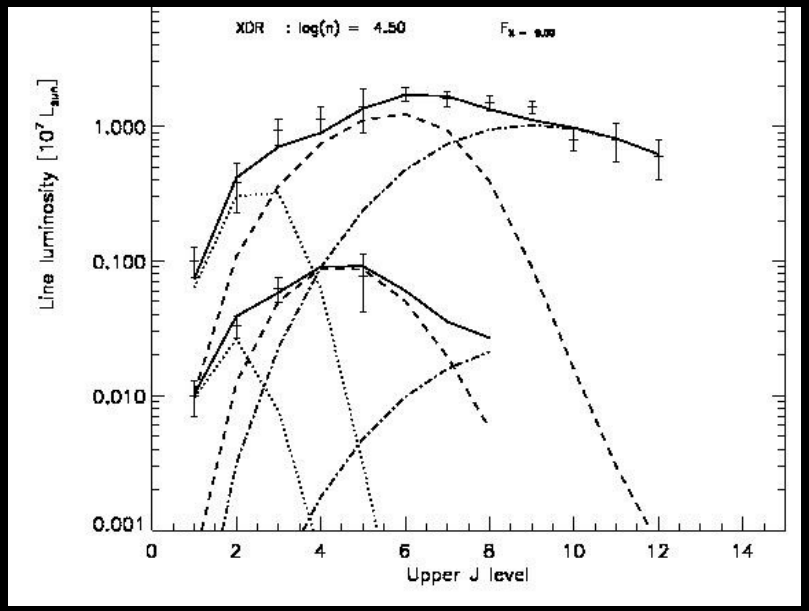
Circumnuclear Disk Models

temperature 100-300 K

density range $3 \times 10^2 - 1 \times 10^5$ cm^{-3}

mass 8.4×10^7 M_{sun}

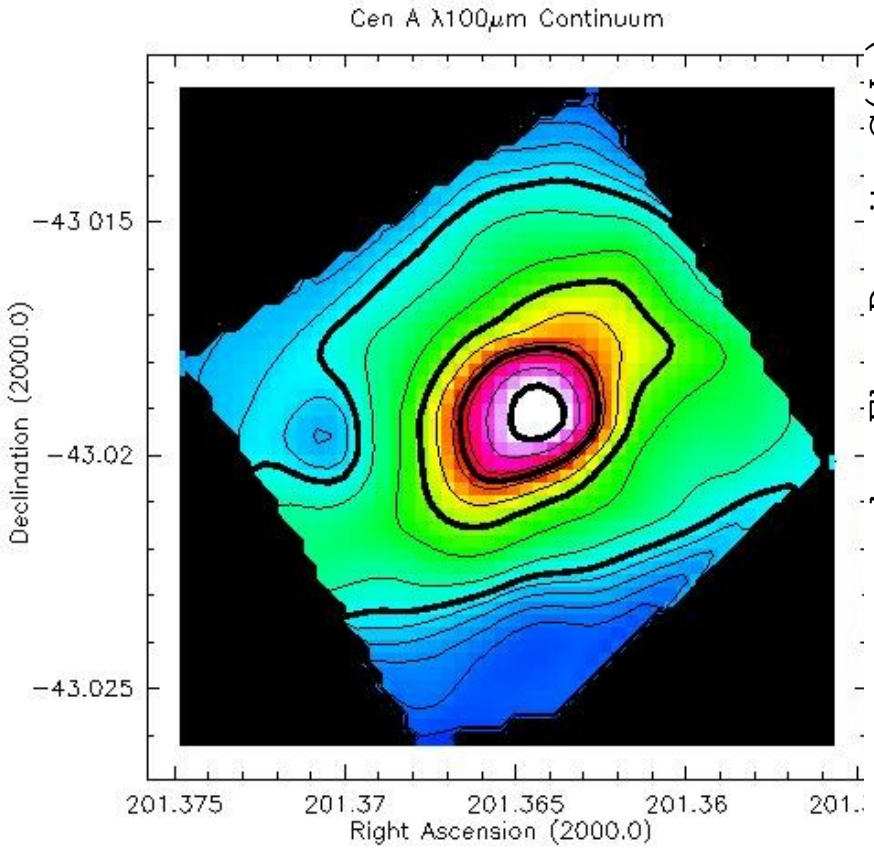


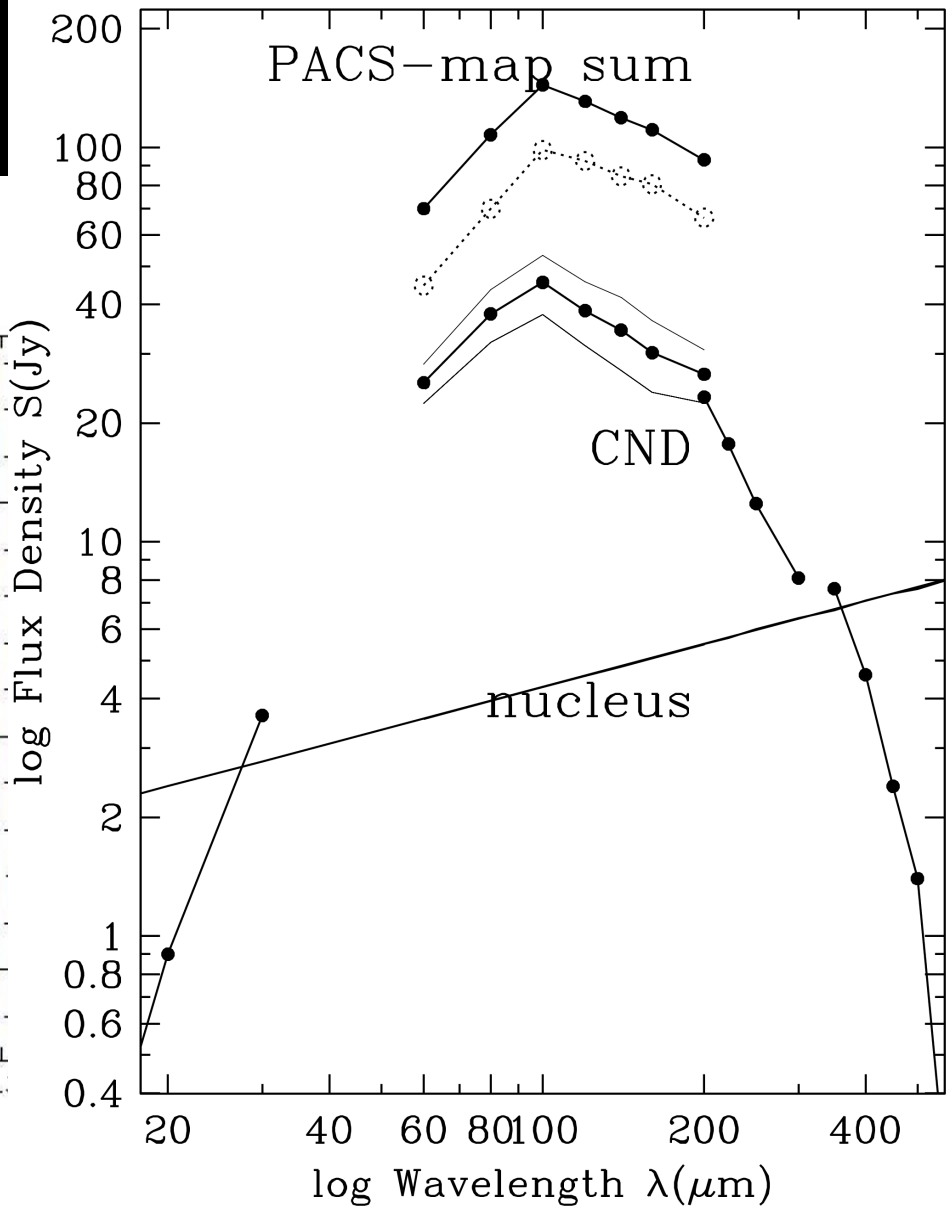


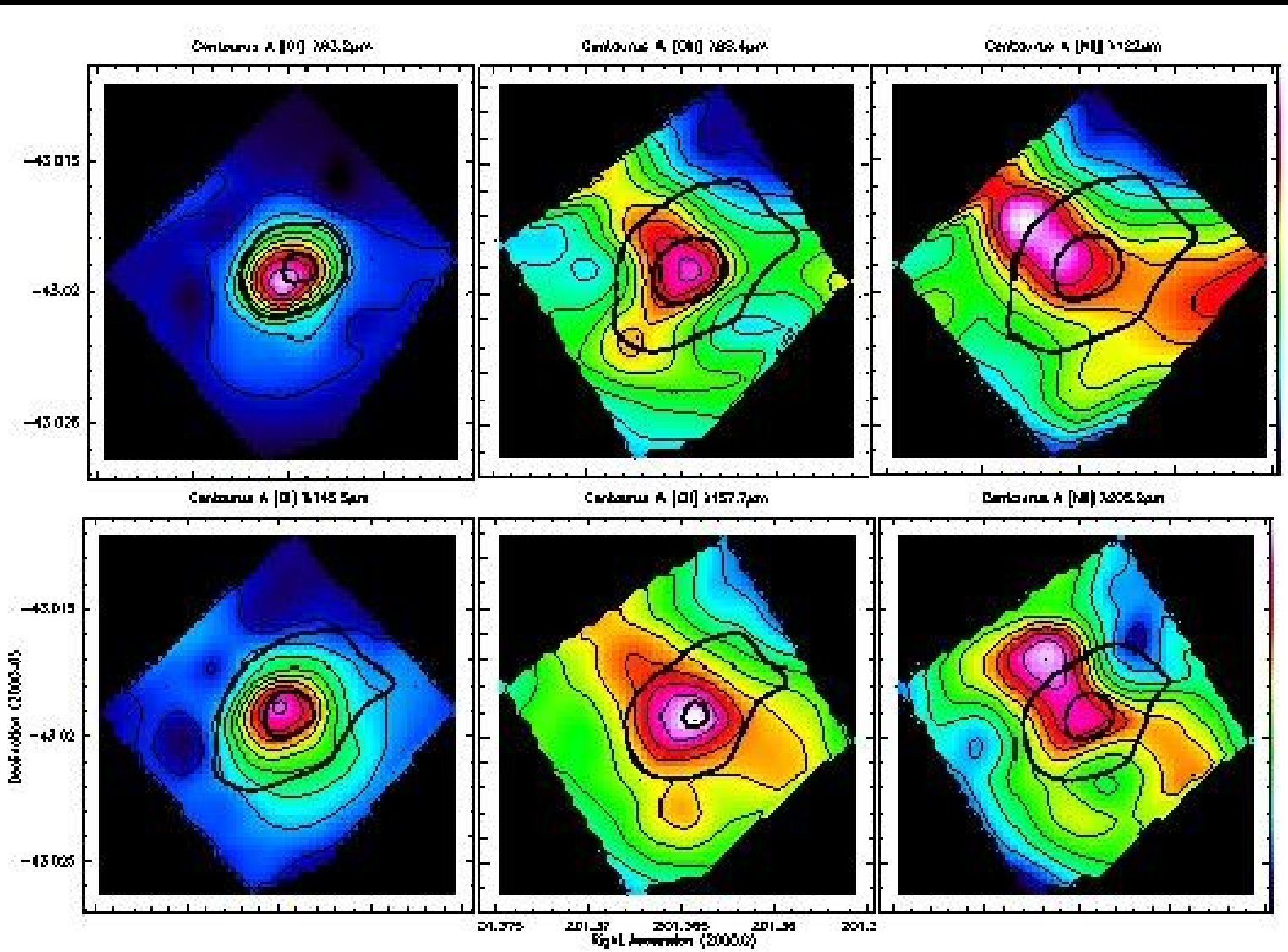
$M_{dust} = 3.5 \times 10^5 M_{sun}$

$T_{dust} = 36$ K GDR 240

beta = 1.2






Centaurus A [OI] 63.2μm
Centaurus A [OIII] 88.4μm
Centaurus A [NII] 122μm
Centaurus A [CII] 158μm
Centaurus A [OI] 145.5μm
Centaurus A [NII] 205.2μm
-43 015
-43 02
-43 025
Declination (2000.0)
201.375
201.37
201.365
201.36
201.3
Right Ascension (2000.0)

Circumnuclear Disk Mass Budget

CND total : $8.4 \times 10^7 M_{sun}$

cold shocked gas : $3 \times 10^6 M_{sun}$

fully ionized gas : $6 \times 10^5 M_{sun}$

warm shocked gas : $4 \times 10^5 M_{sun}$

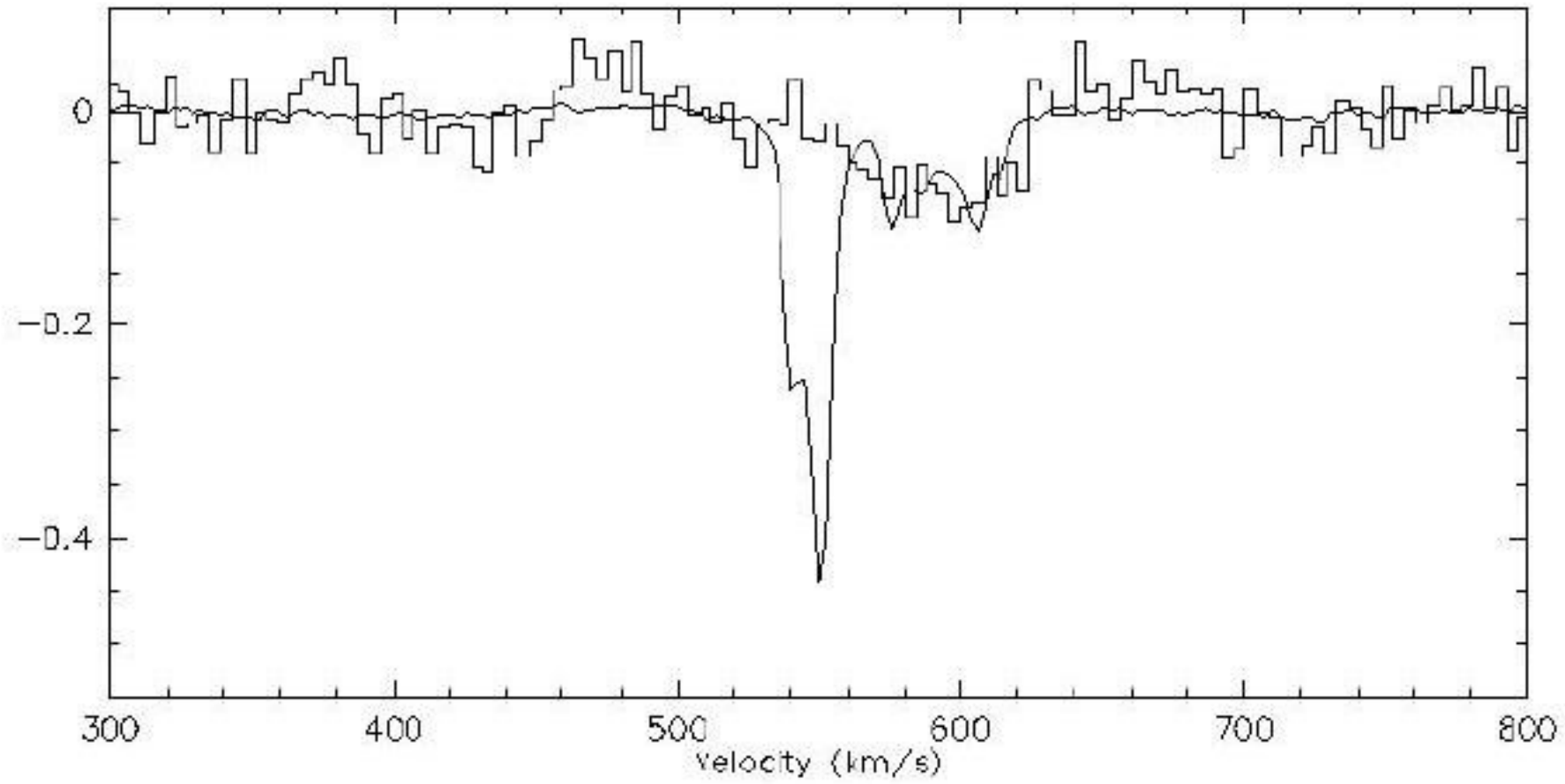
in Jet *outflow*:

$(0.2 – 2.6) \times 10^7 M_{sun}$

CenA *inflow* from CND

HCO+ smooth [CI] histogram

Molecular dissociation?



Dynamical Mass Budget

CND total : 8.4×10^7 M_{sun}

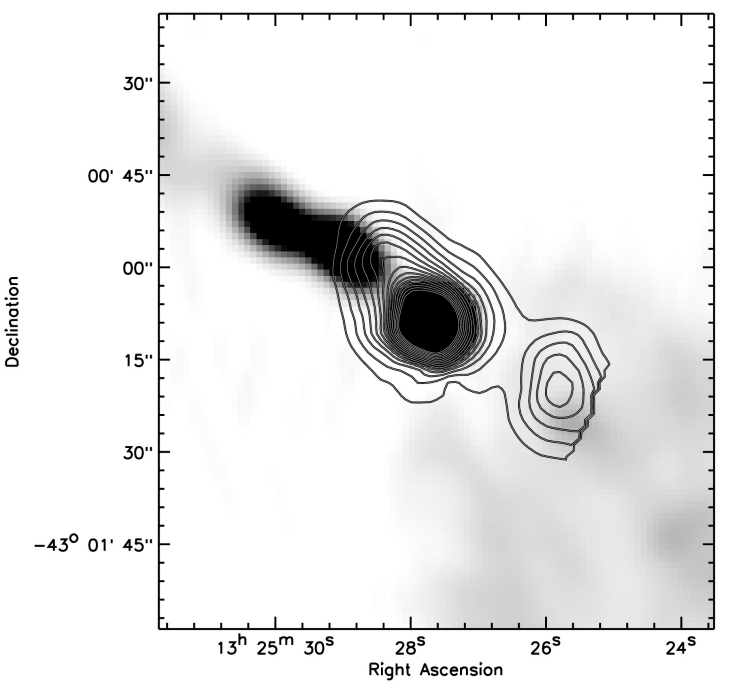
Inflow: 0.5-1.0 M_{sun}/year

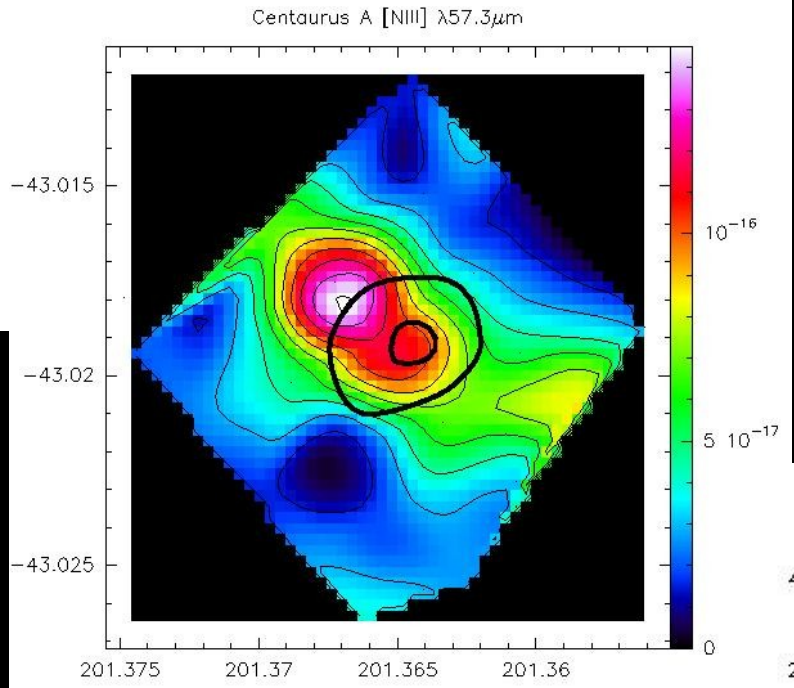
BH accretion: ~ 10^{-4} M_{sun}/year

Star formation : 0.3 M_{sun}/year ??

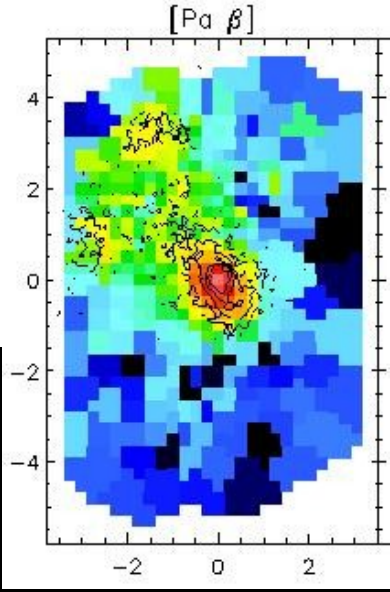
***Jet outflow* : 0.5-6.5 M_{sun}/year**

Quillen et al 2004: [SIV] + 5 GHz





Krajnovic et al 2007: Pa-beta



Secular changes jet position angle ~2 degrees/arcsec

corresponds to jet precession period

25 – 55 million years
(close to Haynes et al, 1983)

CONCLUSION

Mass CND: 5% ISM = 0.1% total
Mass in Outflow: (2 – 30)% of CND
Mass SMBH: 60 % of CND
Dynamical timescales for both outflow and jet precession~4×10^7 yr

Efficient outflow!
Inefficient BH accretion:
timescale at present rate ~10^{11} yr