Dark Matter in the Inner part of the Galaxy M100

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Alma Summer Student Program

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Dark Matter

- Inner part of the nearby galaxy

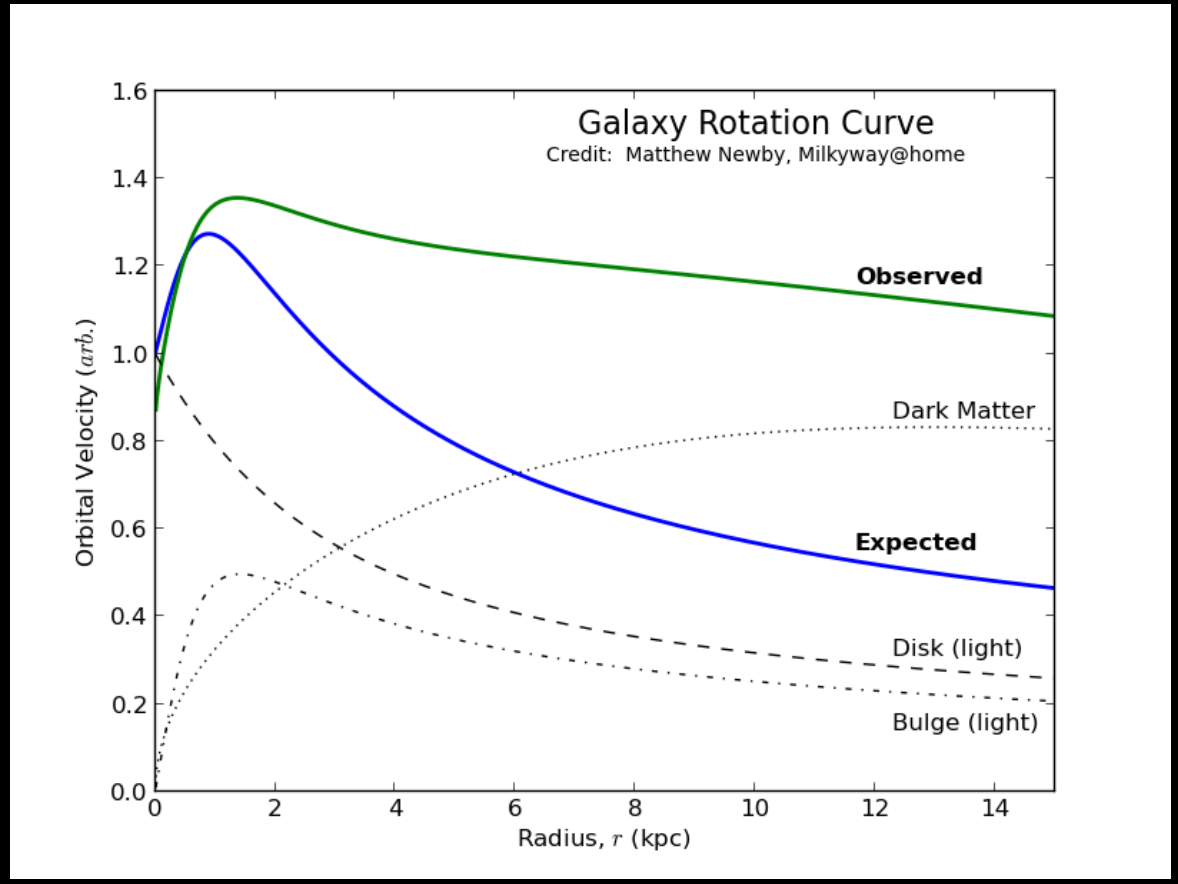


Photo credit:
https://physics.stackexchange.com/questions/134159/what-is-a-flat-rotation-curve

Galaxy

- M100
- z = 0.005251
- Center:

12h 22m 54.931885s

+15d 49m 20.294302s

- Inclination=27°

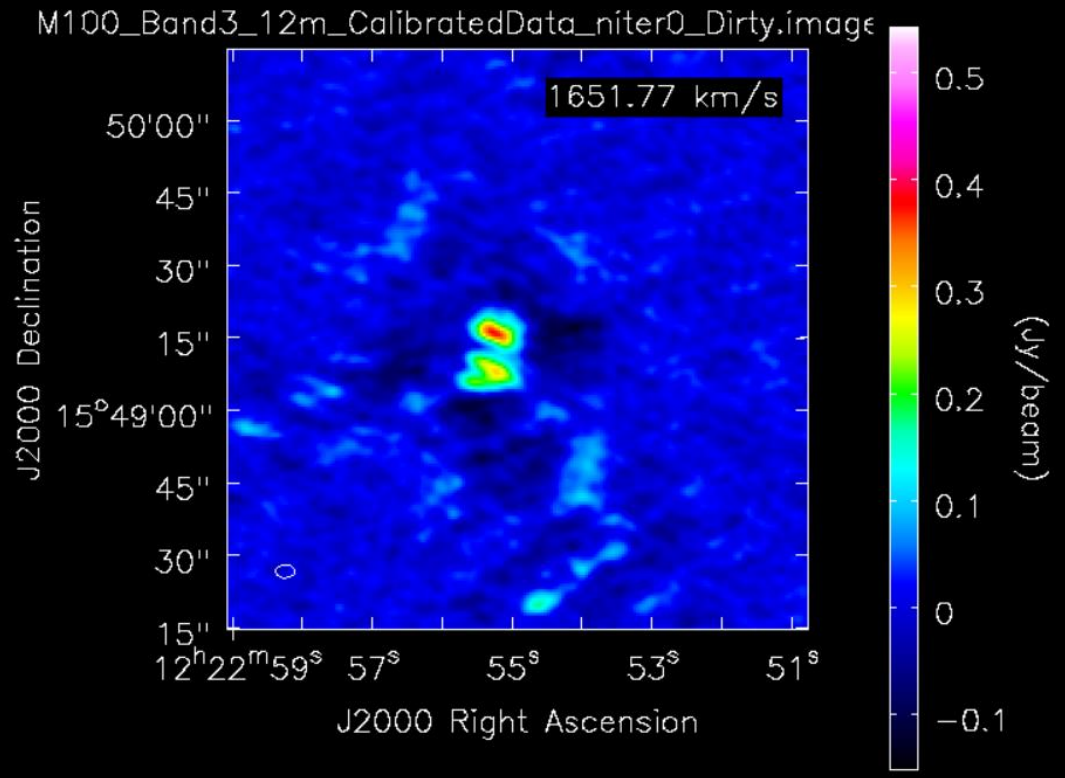
Photo credit：
https://en.wikipedia.org/wiki/Messier_100

Data

- Data from Alma
- Observed from

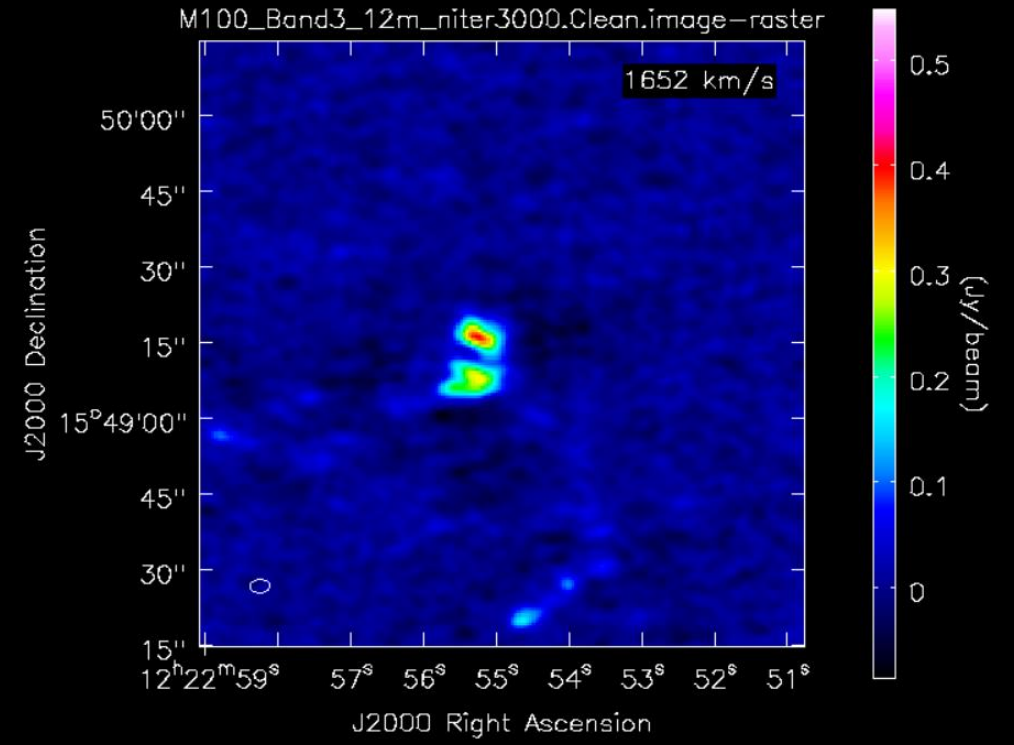
  10-Aug-2011/19:38:05.8 to 10-Sep-2011/21:09:51.9 (UTC)
- Fields:1~47
- Spectral windows: 4 (0,1,2,3)
- Antennas:22(12 m)

Dirty Map



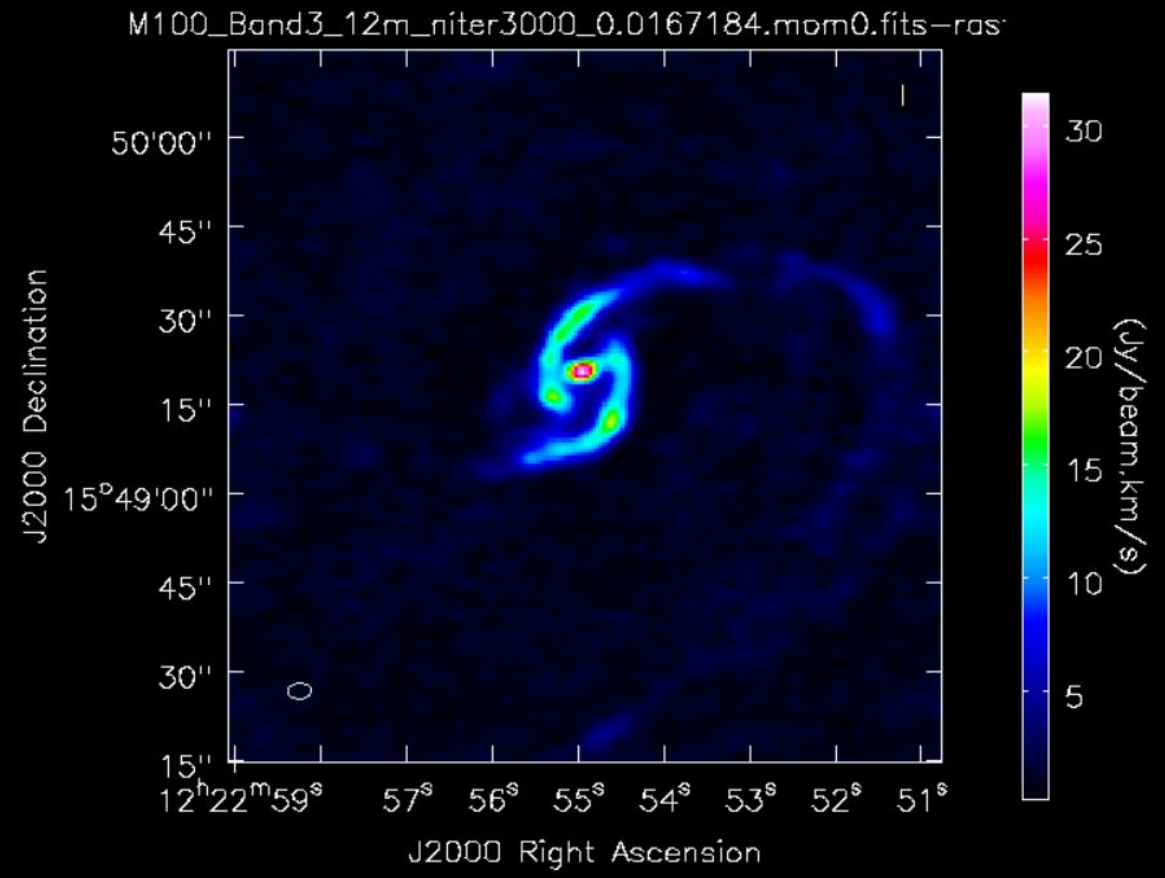
Niter = 0

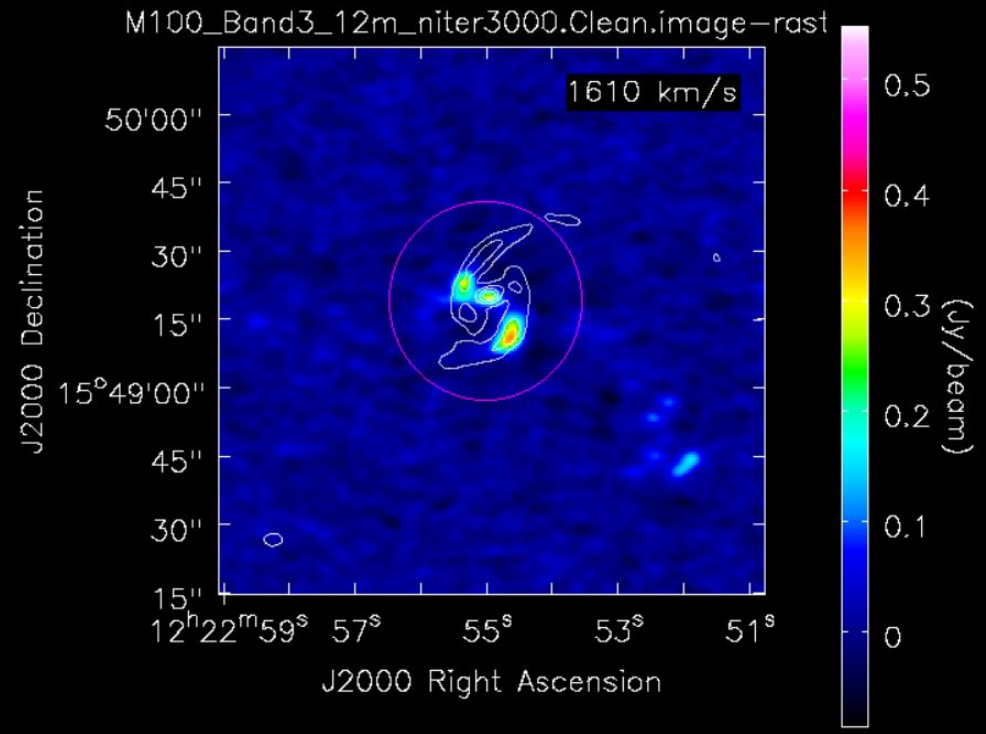
Clean

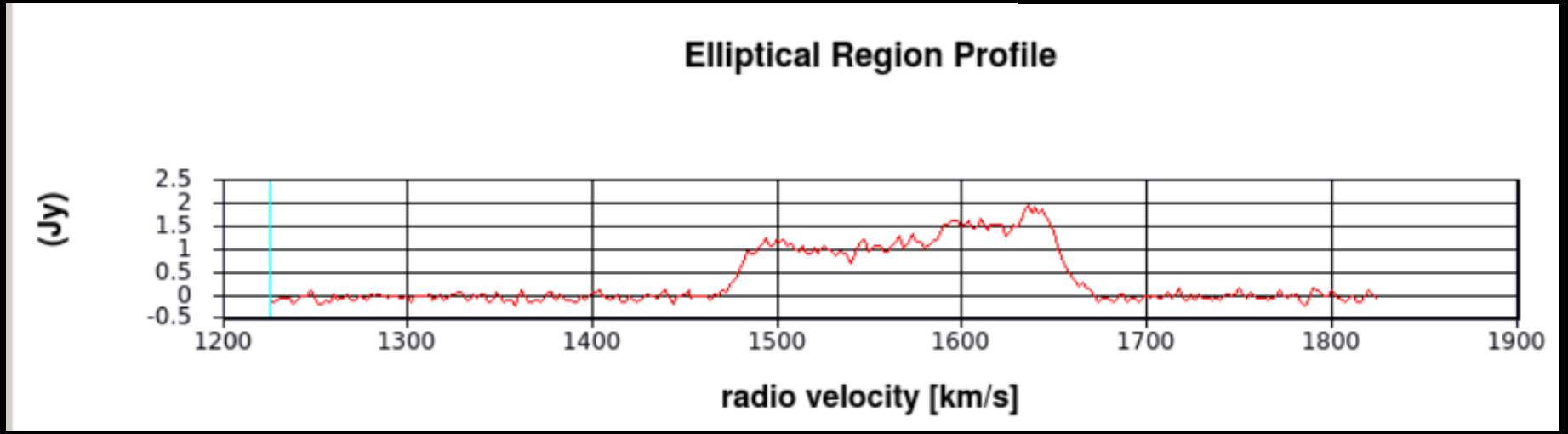


Niter=3000
Threshold=0.0199999 Jy/beam

mom0


M100_Band3_12m_niter3000_0.0167184.mom0.fits-ras
50'00''
45''
30''
15''
15°49'00''
45''
30''
15''
J2000 Declination
12h22m59s
57s
56s
55s
54s
53s
52s
51s
J2000 Right Ascension
30
25
20
15
10
5
(Jy/beam.km/s)


M100_Band3_12m_niter3000.Clean.image-rast
1610 km/s
50'00"
45"
30"
15"
15°49'00"
45"
30"
15"
J2000 Declination
12h22m59s
57s
55s
53s
51s
J2000 Right Ascension
0.5
0.4
0.3
0.2
0.1
0
(Jy/beam)


Elliptical Region Profile
(Jy)
2.5
2
1.5
1
0.5
0
-0.5
1200
1300
1400
1500
1600
1700
1800
1900
radio velocity [km/s]

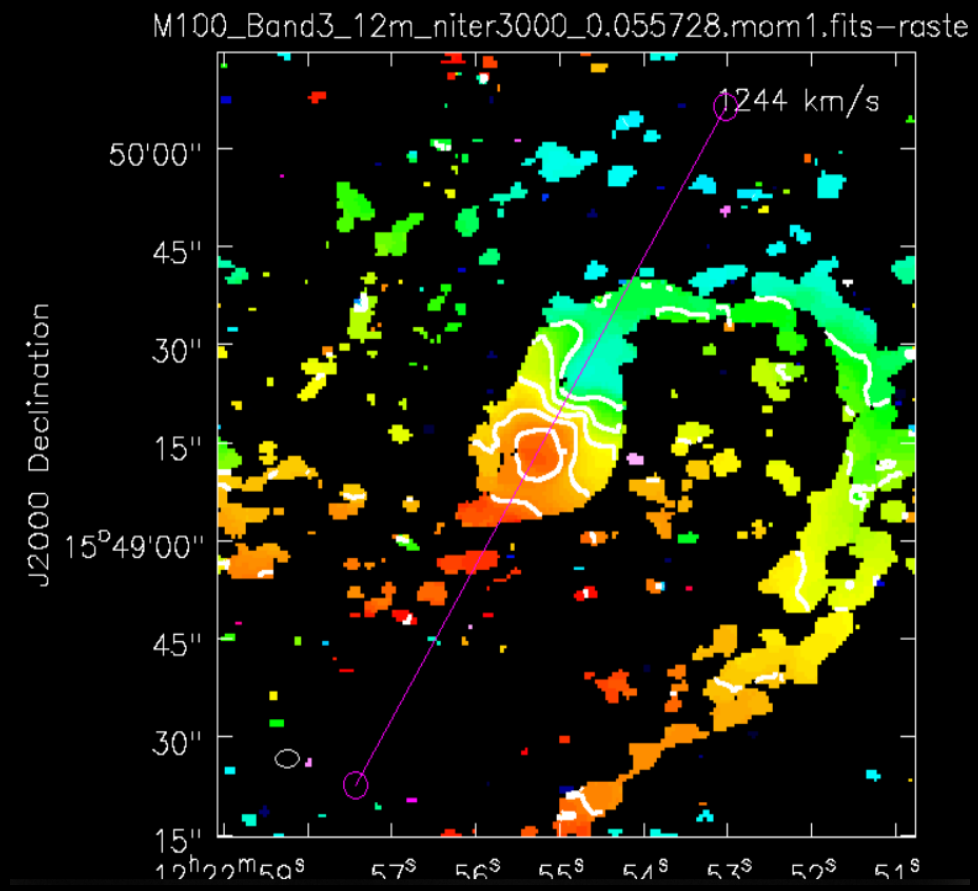
Mass

- M_{mol} = $1.05 \times 10^4 \times \left(\frac{X_{CO}}{2 \times 10^{20} \frac{cm^{-2}}{K\ km\ s^{-1}}} \right) \times \frac{S_{CO} \Delta v D_L^2}{(1+z)}$

(Alberto D. Bolatto, Mark Wolfire, Adam K. Leroy 2013)

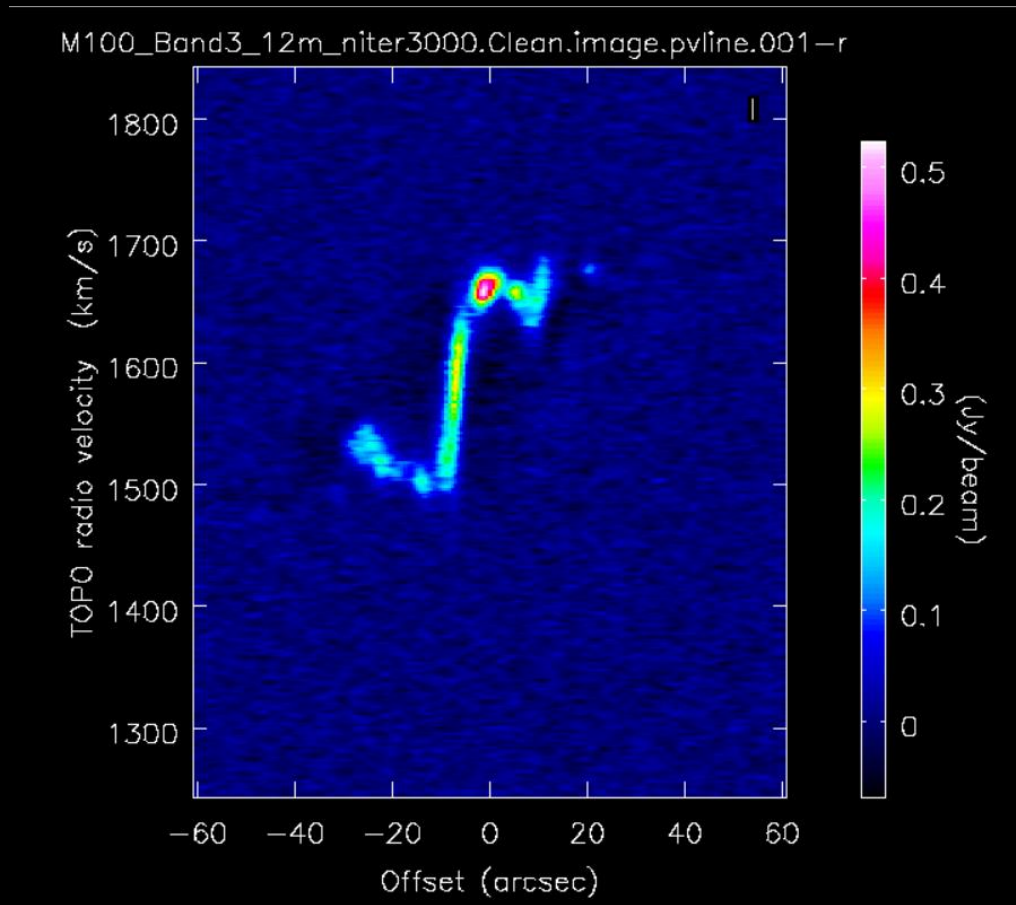
- $M_{mol} = 7.1 \times 10^8 (\mathrm{M}_\odot)$ ……2.54kpc
- Comparison:
- **3.1×10^9** (3.37kpc)
- (Jazeel H. Azeez et al. 2016)

mom1



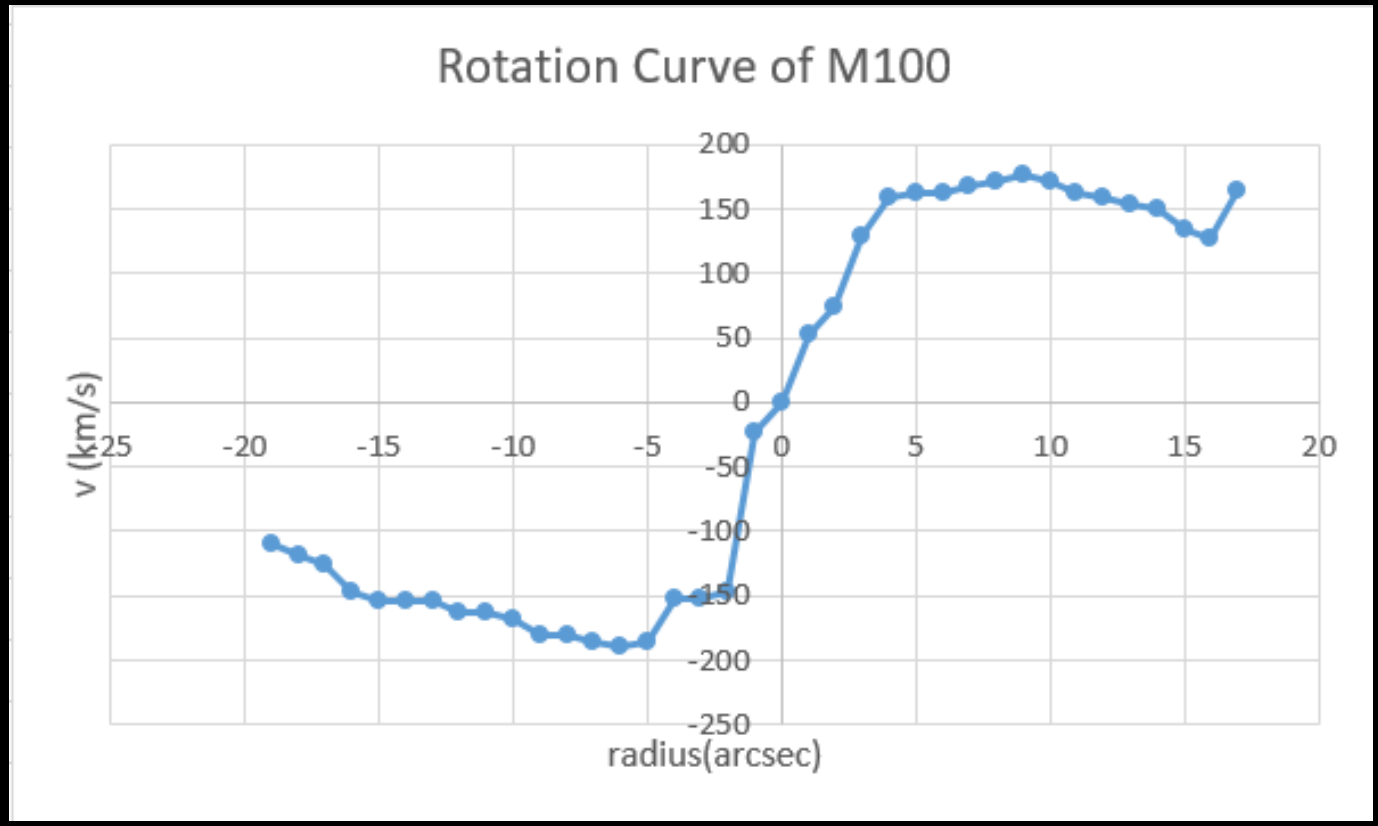
- Position angle: -31.53°

PV diagram



Rotation Curve

- 1kpc : 9 arcsec
- $M_{dyn}=v^2\frac{r}{G}$
- M = 7.22 x $10^9 M_\odot$
- **Cannot use this equation.



Thanks for listening☺