The 10th European VLBI Network Symposium

Early cycle of matter in active region of star formation, and AGN objects

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1. St Peterburg University, 2. Boston University, 3.MPIFR, 4.Jodrell Bank

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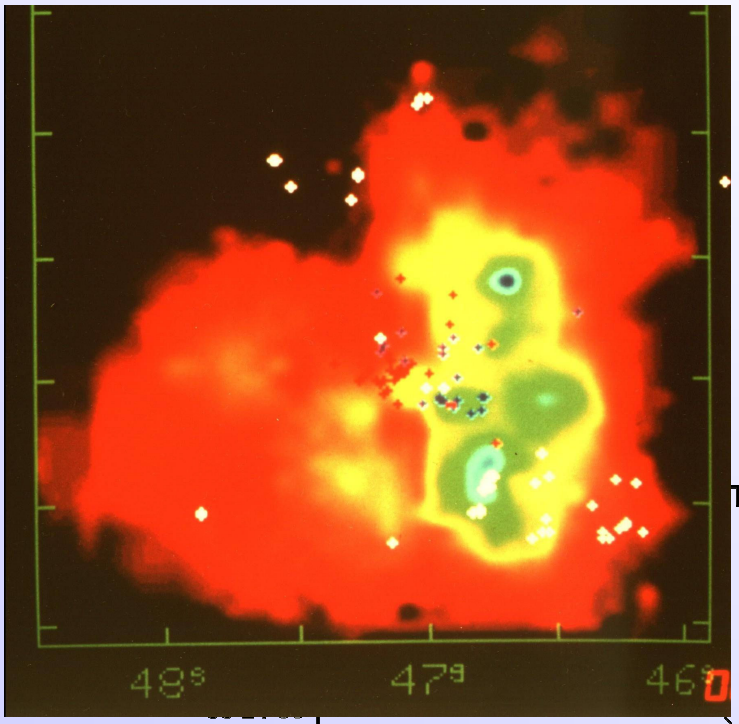
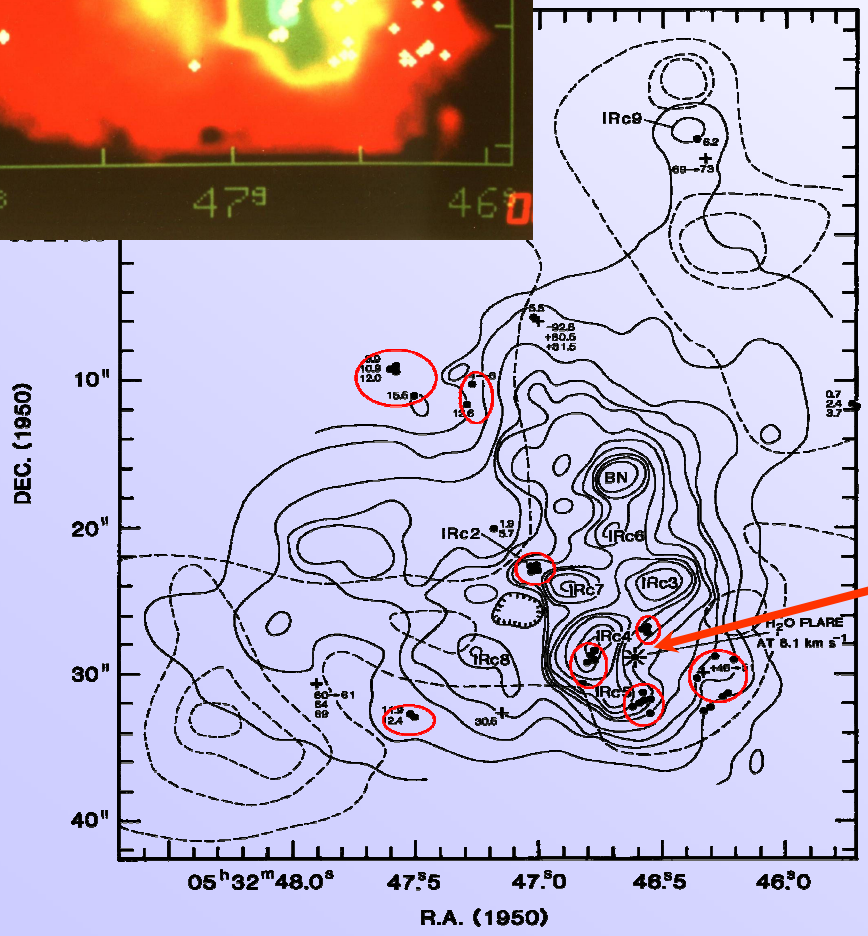
ORION NEBULA





1968 – *discovery*
H_2O radiation in gas-dust complexies, (Ch.Townes et al.)

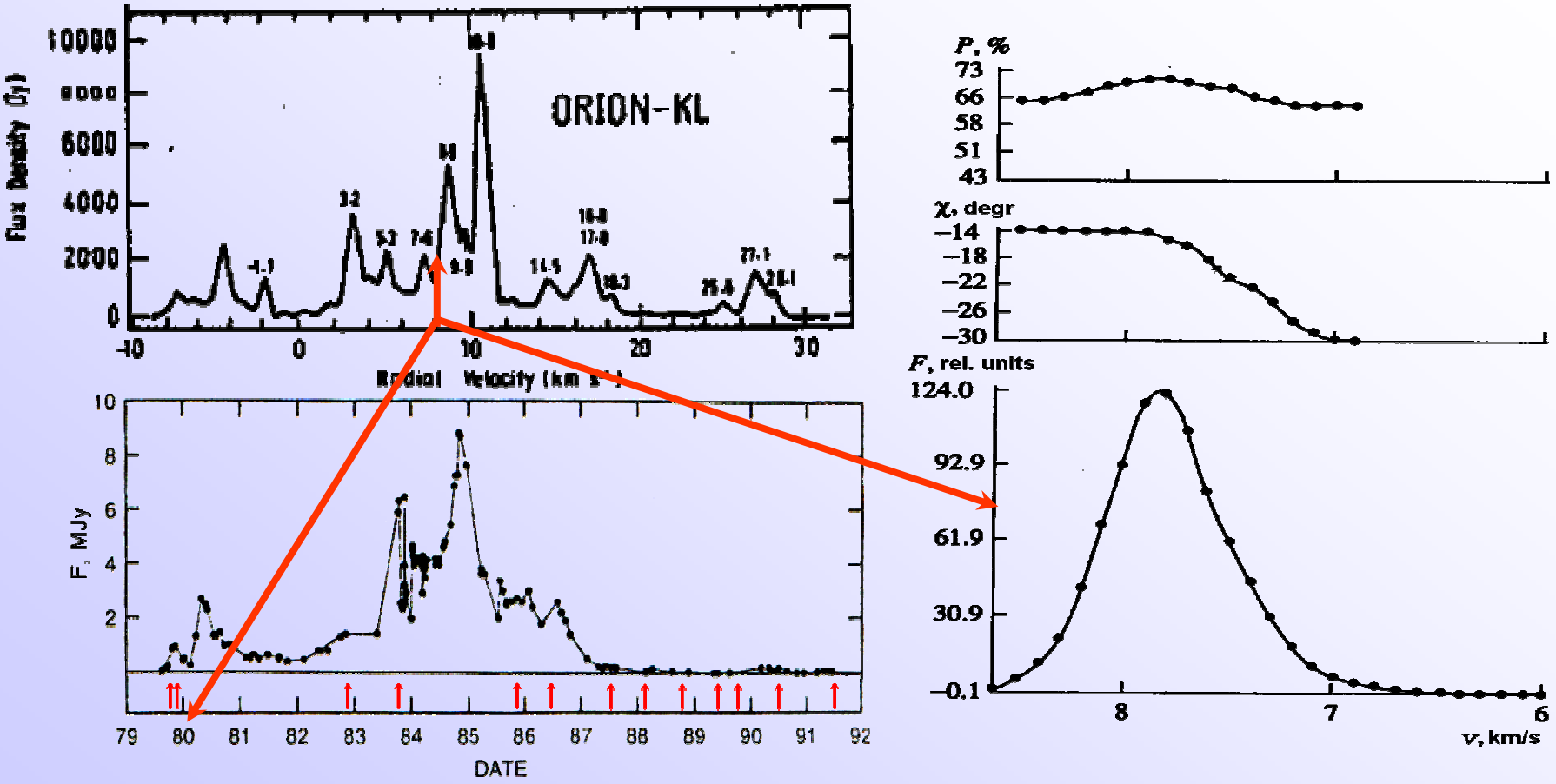
1971 – VLBI: КР – HST – W 49, ORION

8 active zones

Region of the Mega maser

1979-1987- global VLBI
1995-2003 - VLBA

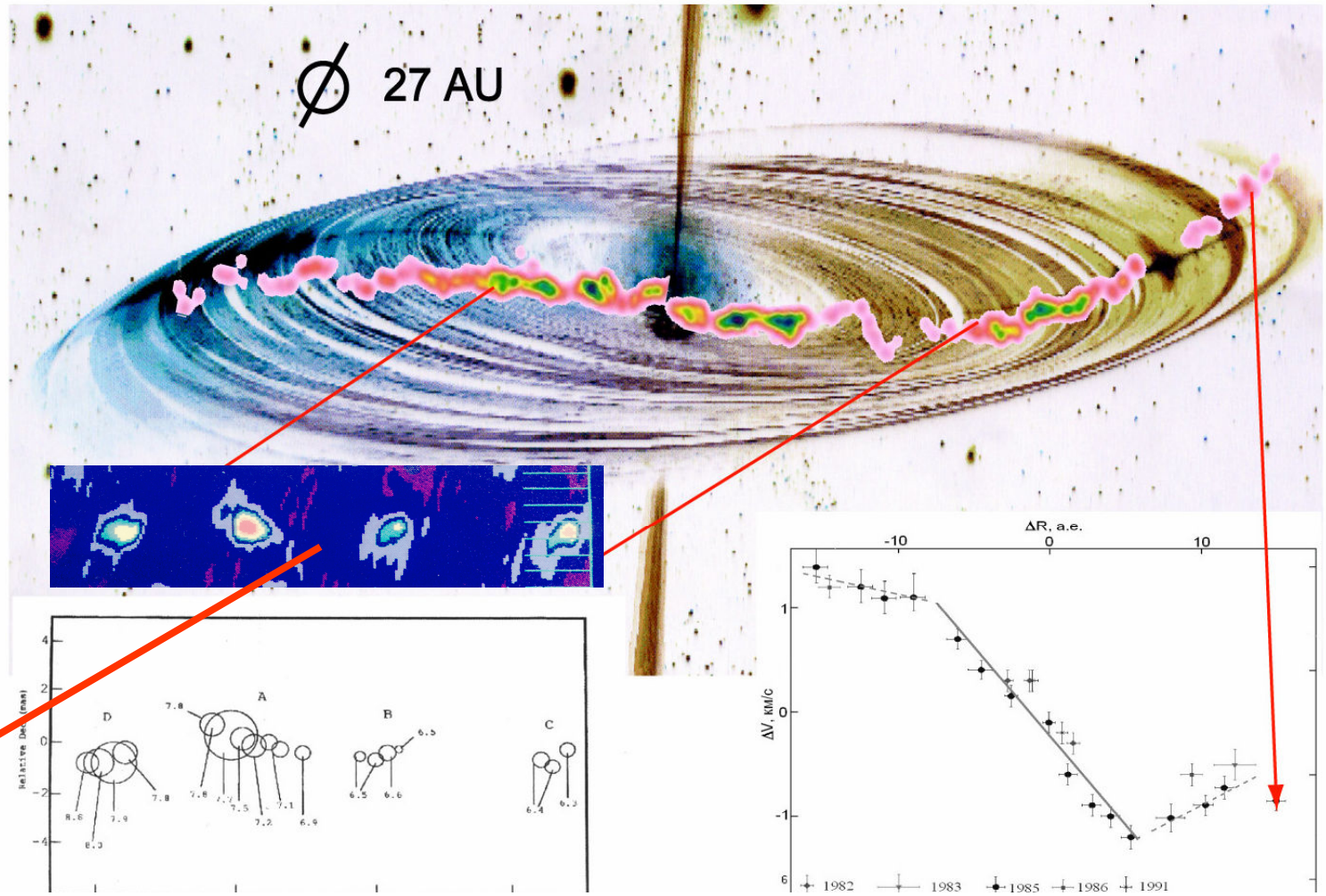
•H_2O MEGA MASER OUTBUSTS 1979-1987



•V_o = 7.65 km/s, ΔV ≈ 0.5 km/s, F ≤ 8 MJy.

Polarization m ≥ 70%. dX/dV ≈ 25^0 / km/s ?!

ACTIVITY 1979 - 1987 yrs



Chain of compact components

brightness Ø = lgT_b, $T_b \leq 10^{17}$ K

Rigid body rotation $V \approx \Omega R$, T => 170 yr

Keplerian: $R \geq 7$ *AU,* $M < 0.01$ *Msun*

Tangential directions of rings or helix arms

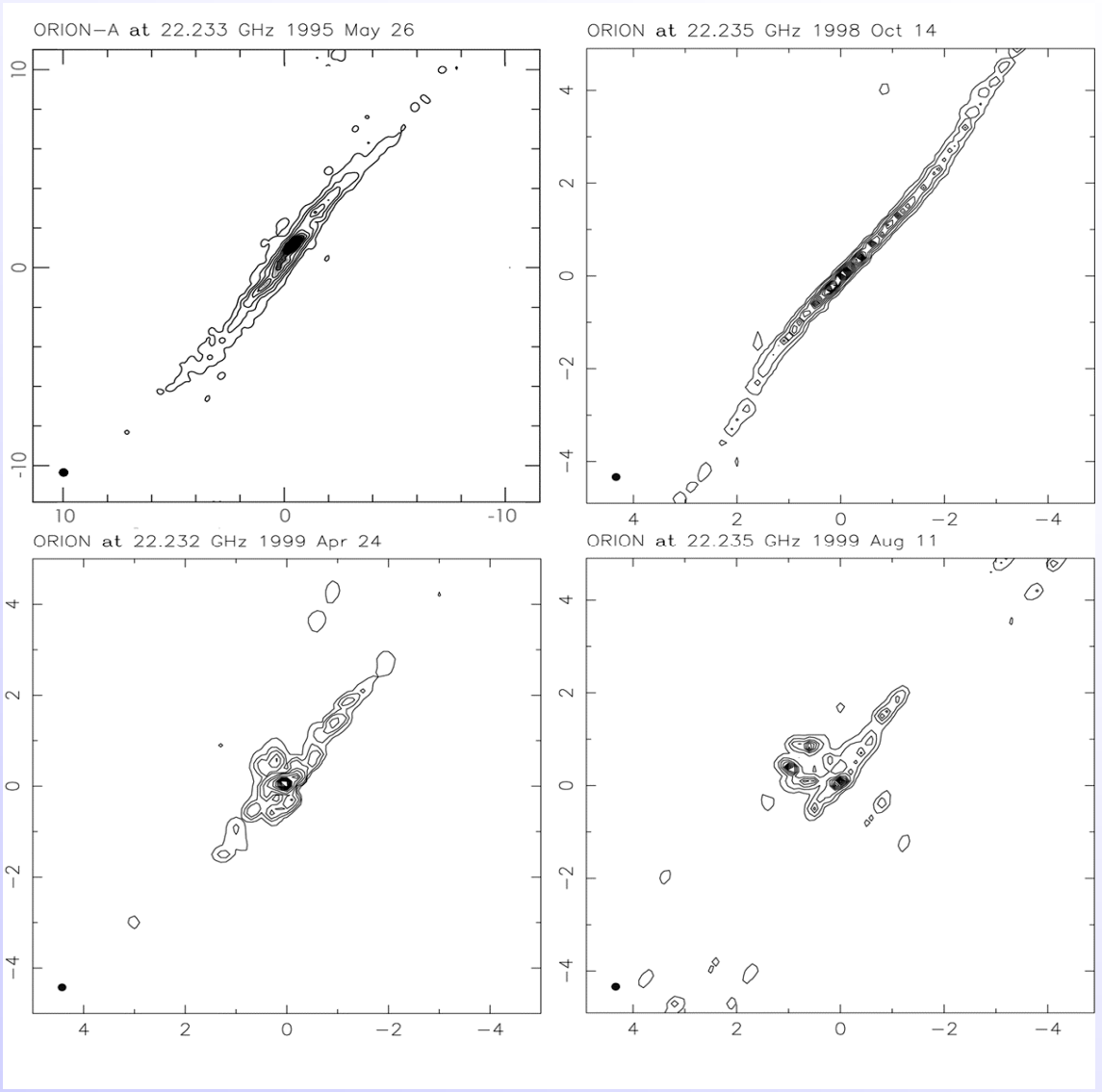
•The structure 1995-1999

Silence - jet:
size ± 3 AU, Tb ~10^12K

Active 1998-1999:
Tb ≈ 10^14 K (G=>10^3)

April 1999: Tb ≈ 10^13 K

Torus Ø=1 ae, Tb ≈ 10^13 K



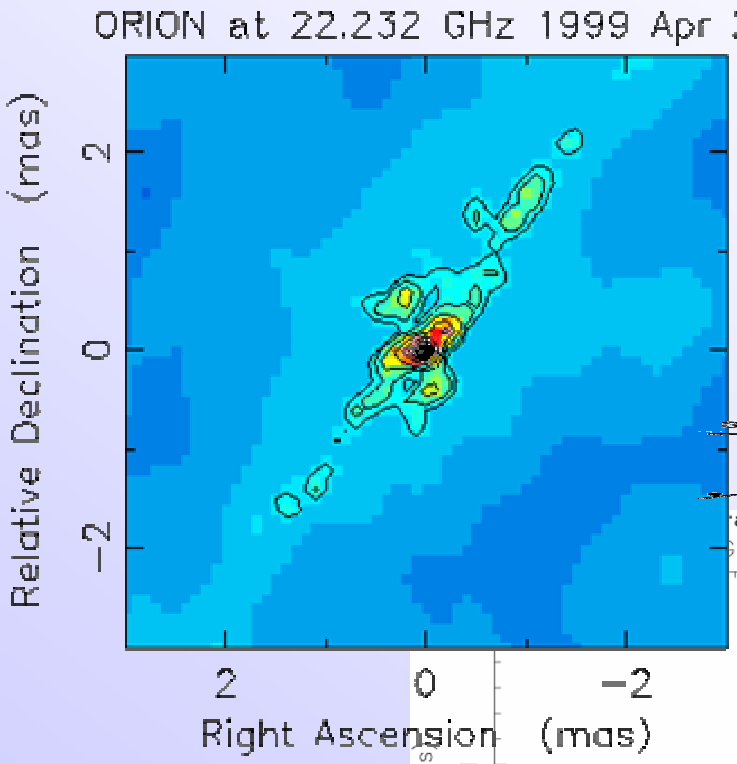
EJECTOR

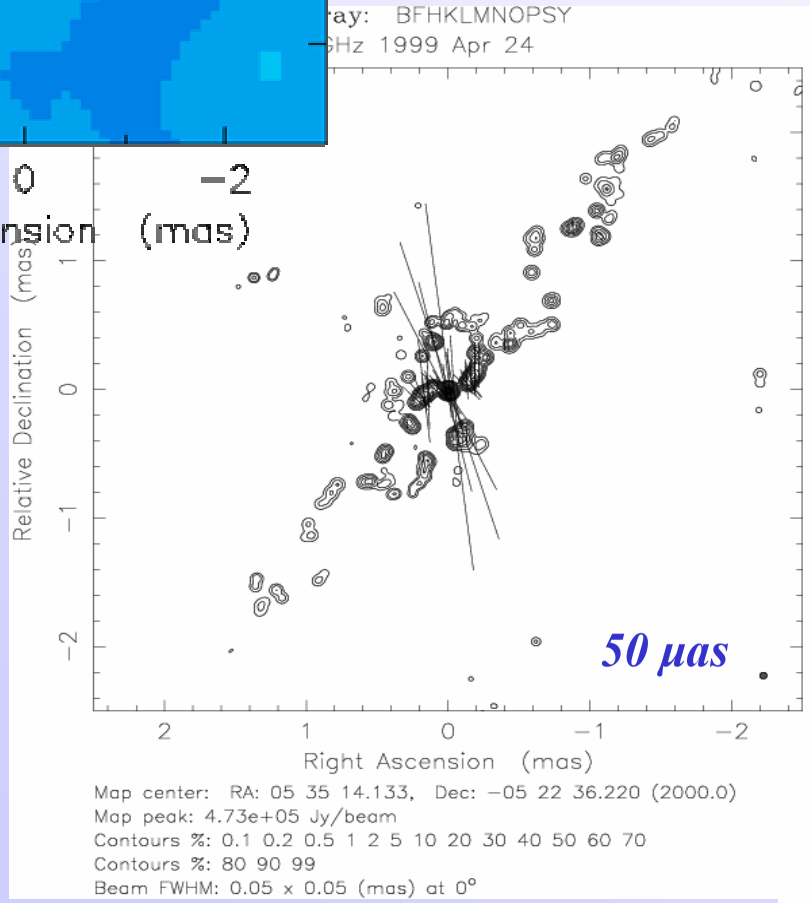
Double nozzle - 0.004 AU

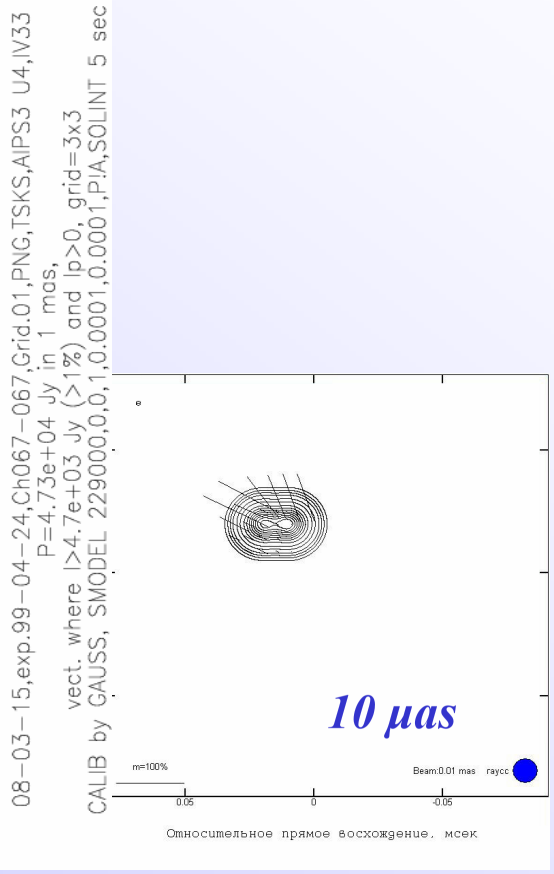
Polarization - ΔX = 44º

Velocities Lines - ΔV = +/- 0.2 км/с

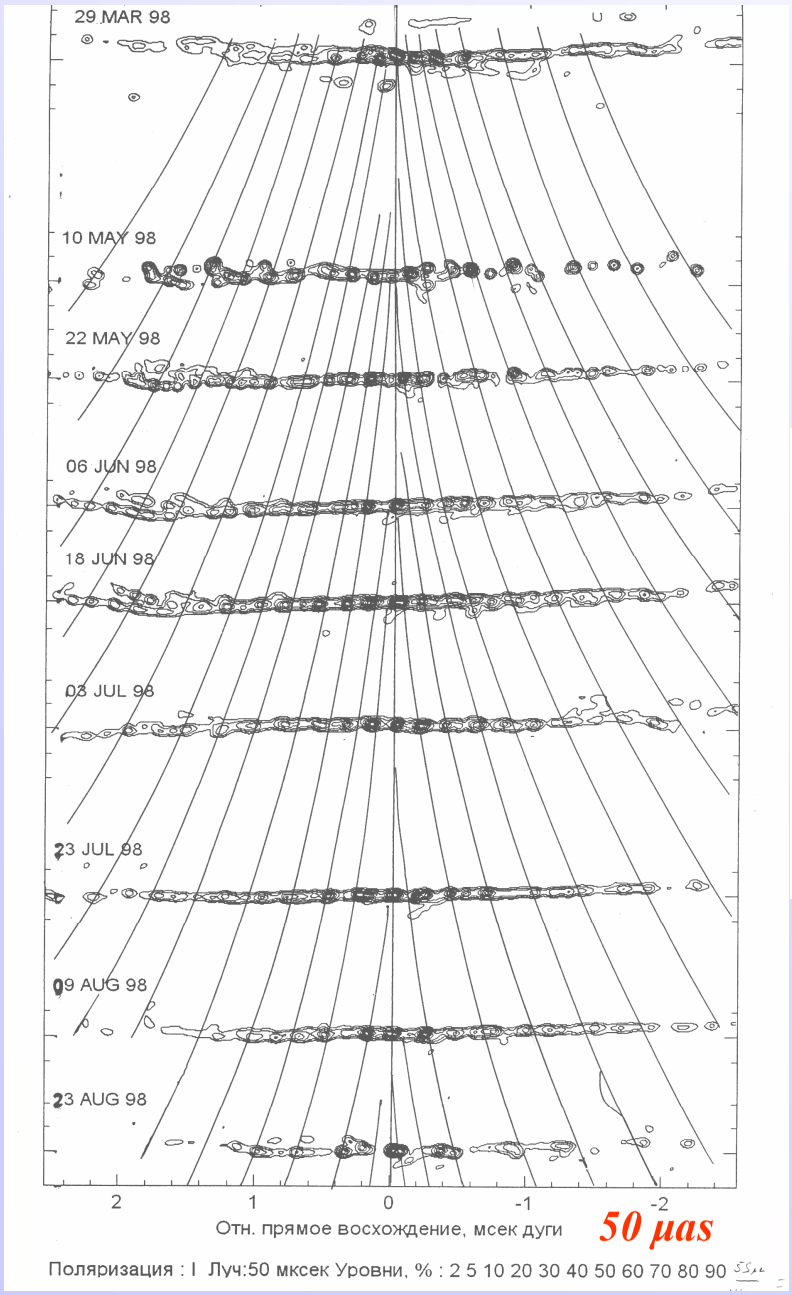
Precession period T ~ 10 yrs







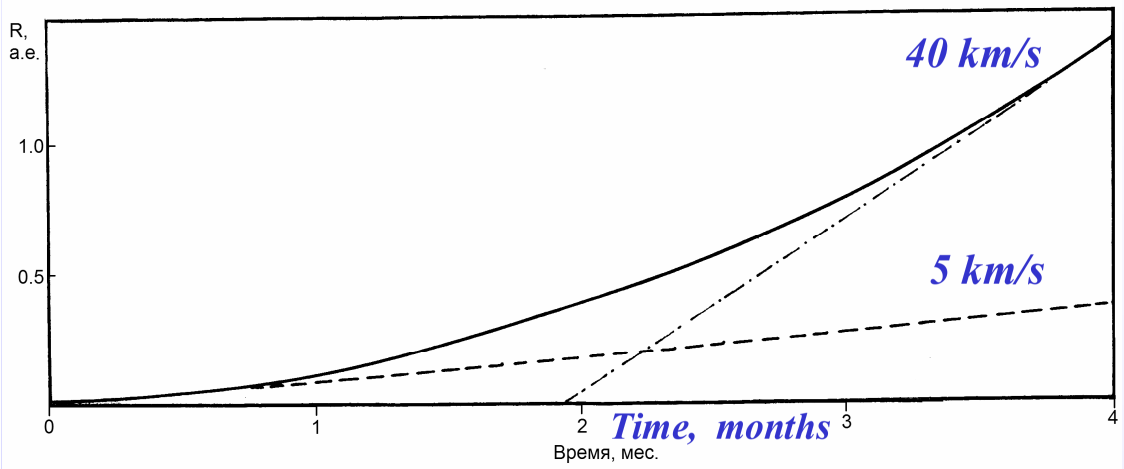
Bipolar outflow 29.03-23.08.98



Movement of H_2O components exeleration

$v_o \leq 5$ km/s, $a \approx 1.5 \times 10^{-6}$ km/s^2

Collision pumping $v \leq 50$ km/s



Structure of the star formation region:

Disk

Diameter ~ 30 AU, divided into helix arms

rigid body rotation, period T ≈170 yrs

Bipolar outflow

Rotating high collimating outflows

Precession - helix structure

Envelope / surrounding matter

Amplification orders at V_{LSR}=7.65 km/s, $\Delta V \approx$ 0.5 km/s

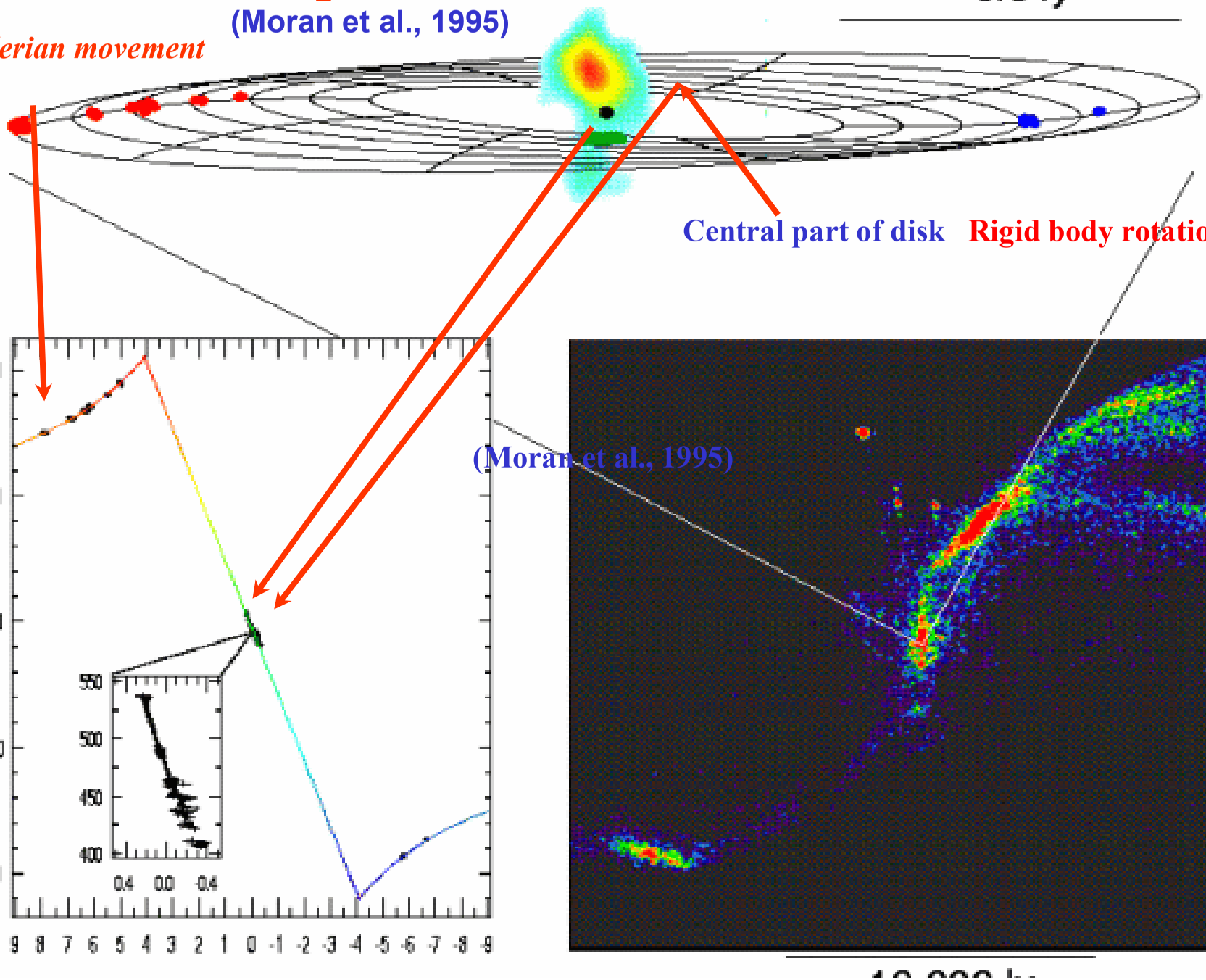
Central body $M < 0.01\ M_{sun}$

Whirlwind - cosmic tornado ?

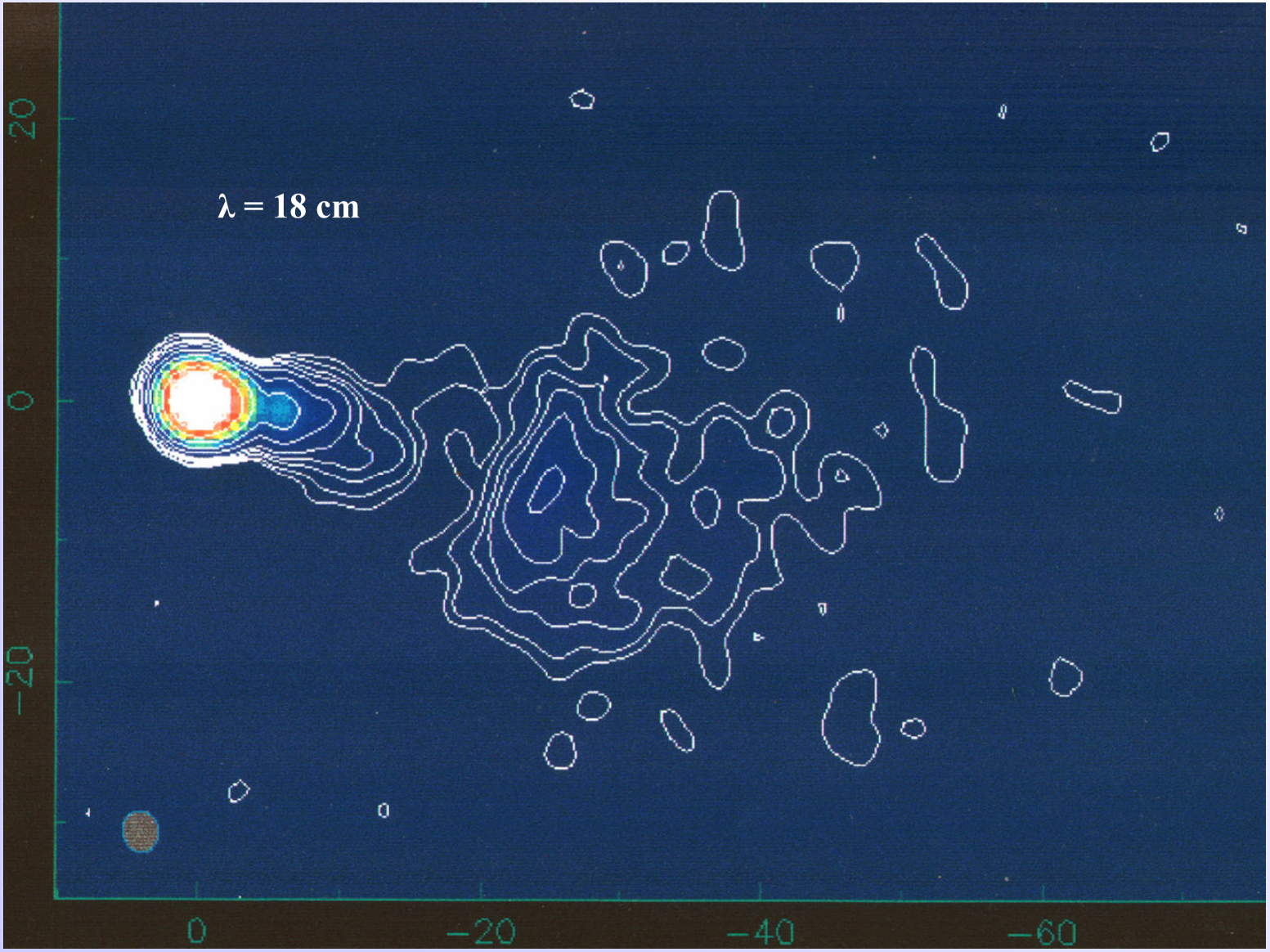
NGC 4258, H_2O maser radiation

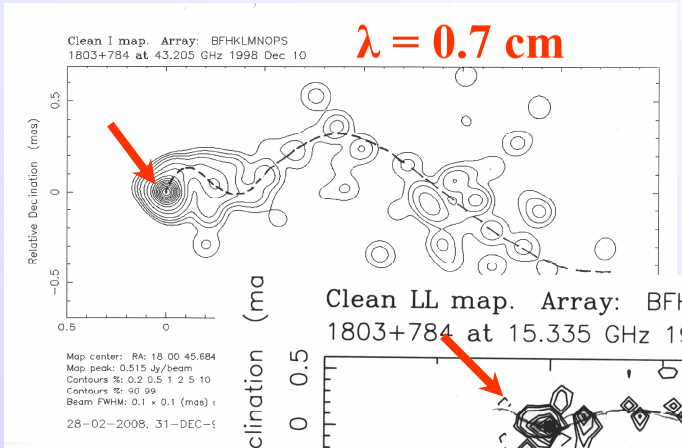
(Moran et al., 1995)

Keplerian movement



AGN 1803+784





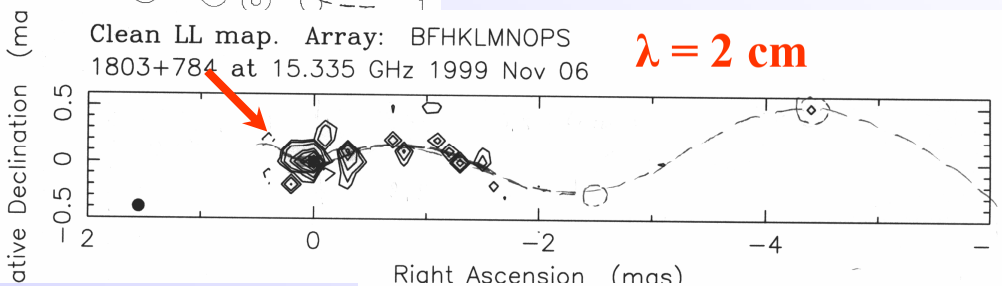
λ = 0.7 cm

Helix ~ sin{Ω(t)t}

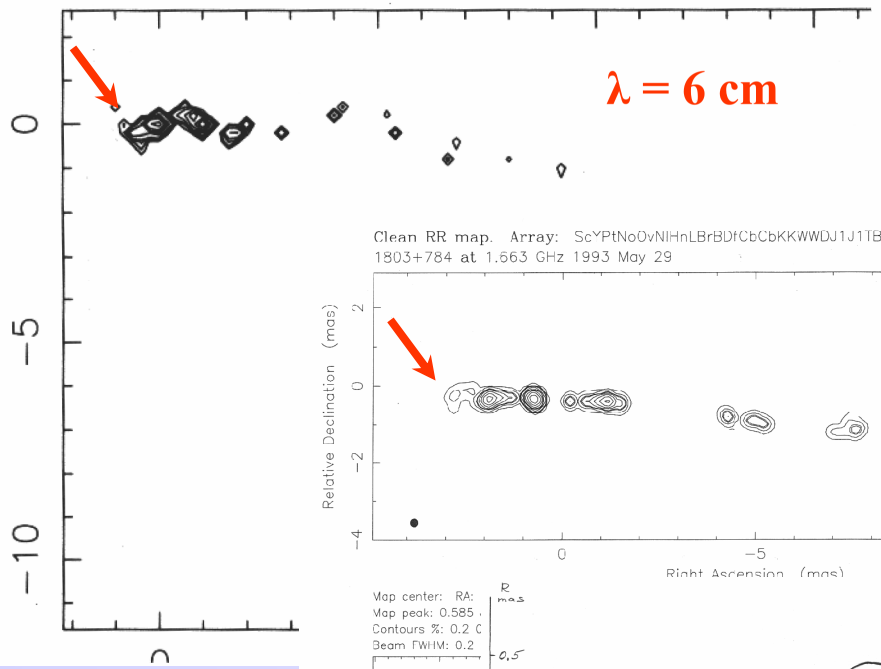
Multi precession $\Omega_2/\Omega_1 \approx 30$

LM et al. Atron. Lett.2010,36,151

θ = 0.2 mas



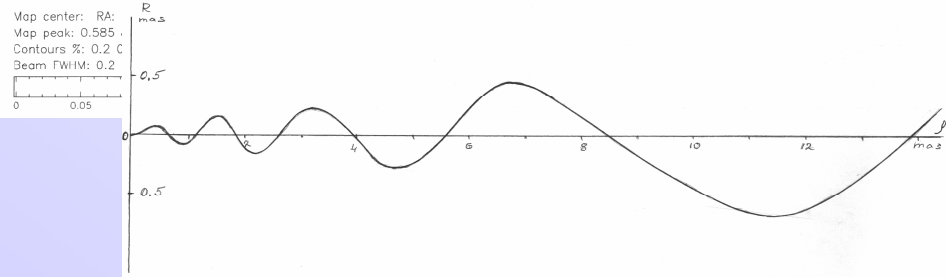
λ = 2 cm

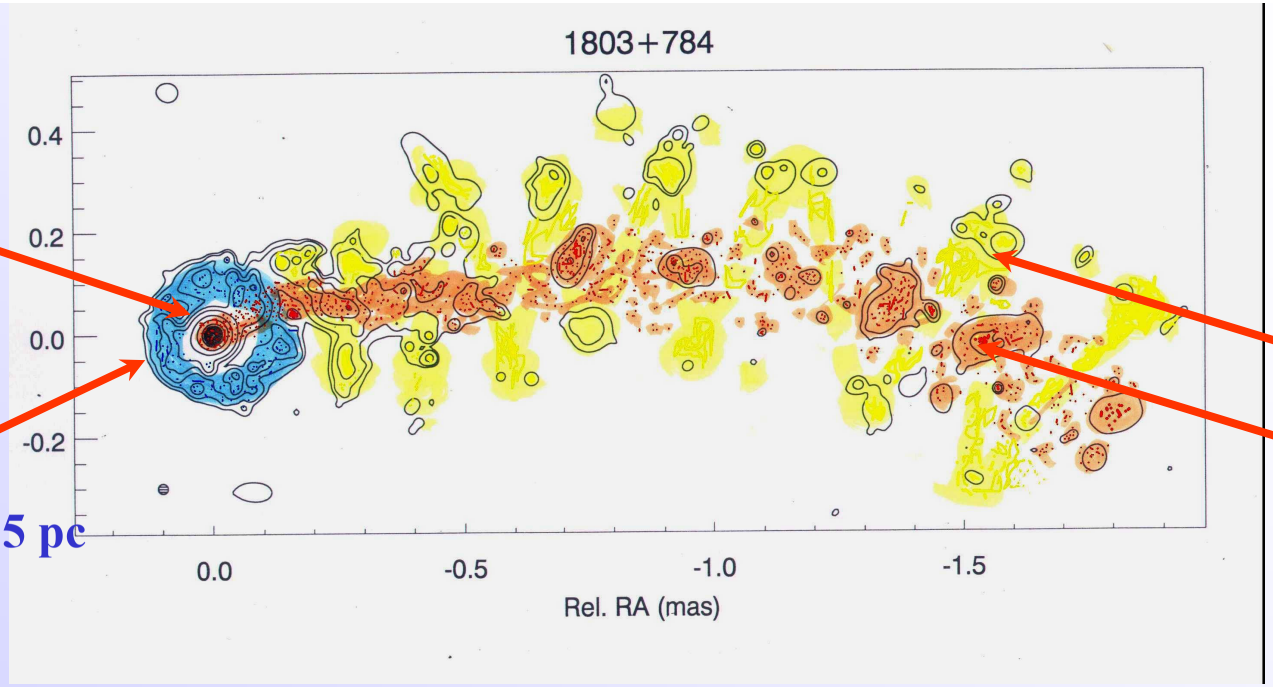


λ = 6 cm

ρ ~ 5 pc=> acceleration zone

λ = 18 cm



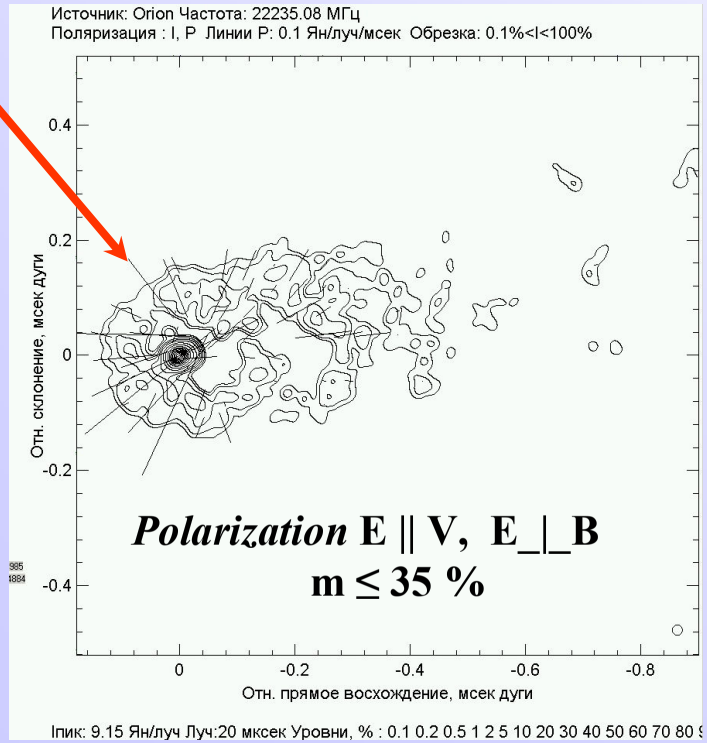


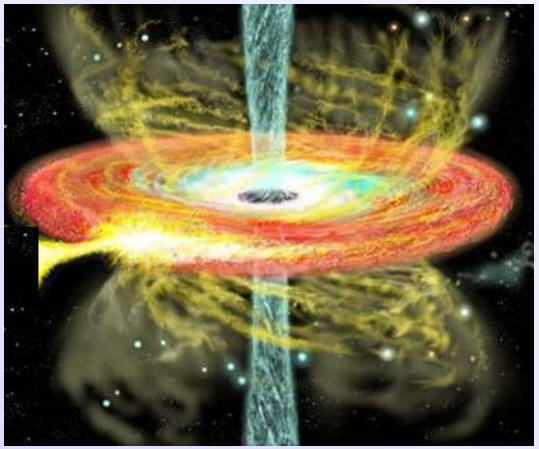
~ 0.5 pc

Disk ~ 1.5 pc

1 mas = 6 pc

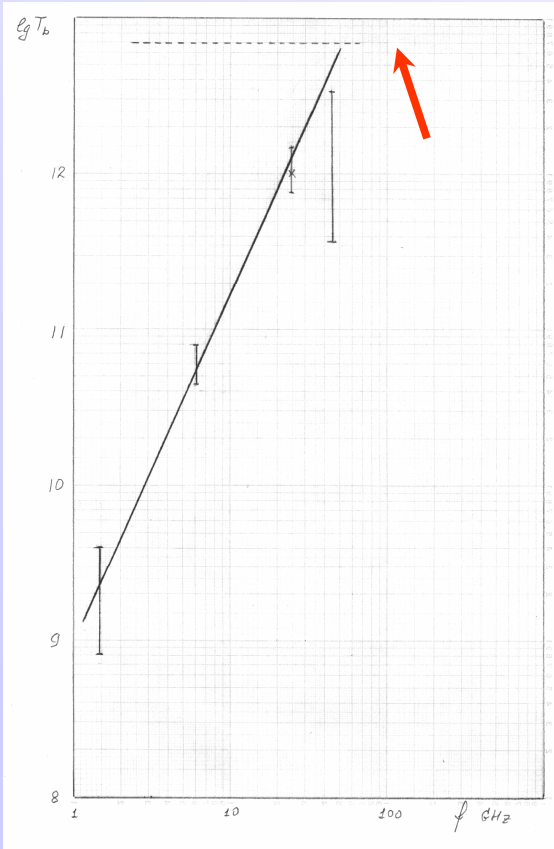
V ~ 4 v

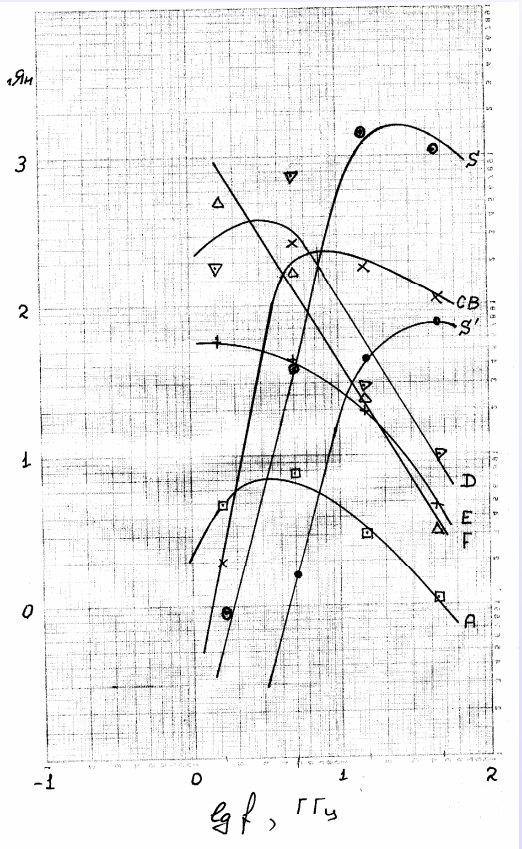


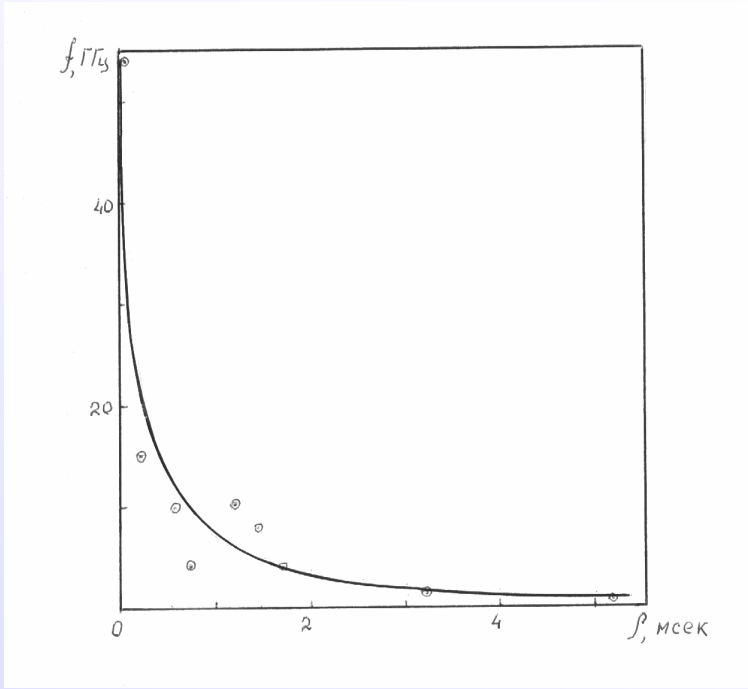


COMPONENT SPECTRUMS
1803+784

Brightnes temperature -Tb(f) **Spectrums - F(f).** **Cutoff frequency – f (ρ).**



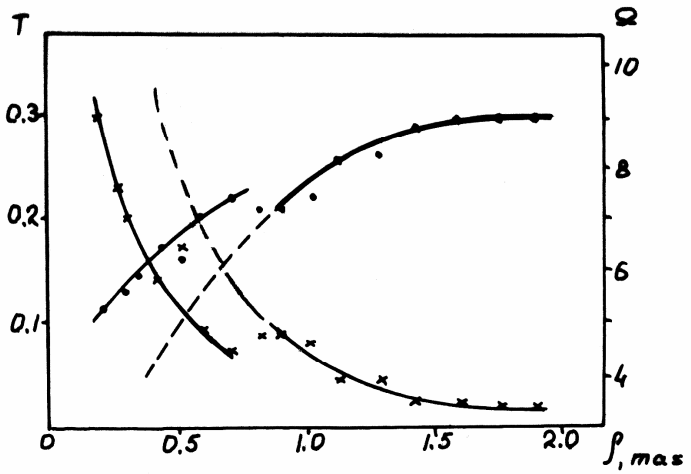




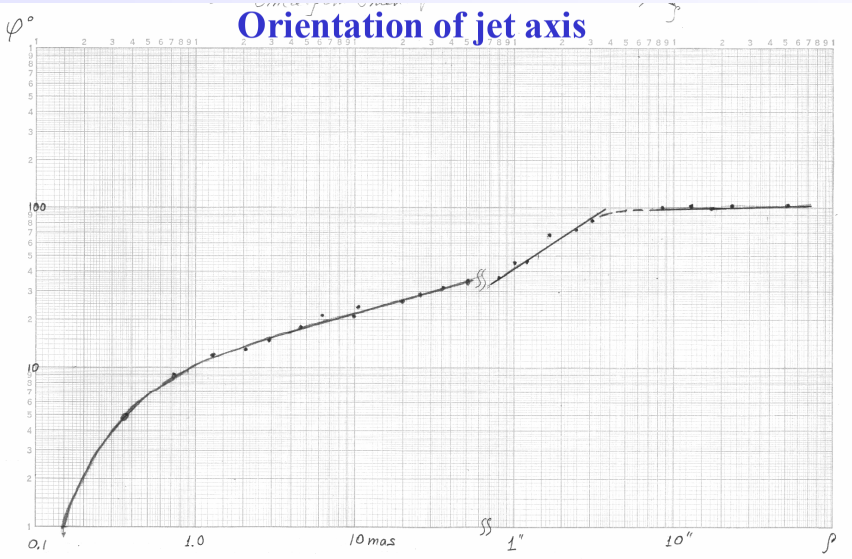
λ=18 cm, T_{peak} = 8x10¹² K, absorption β= -35 dB

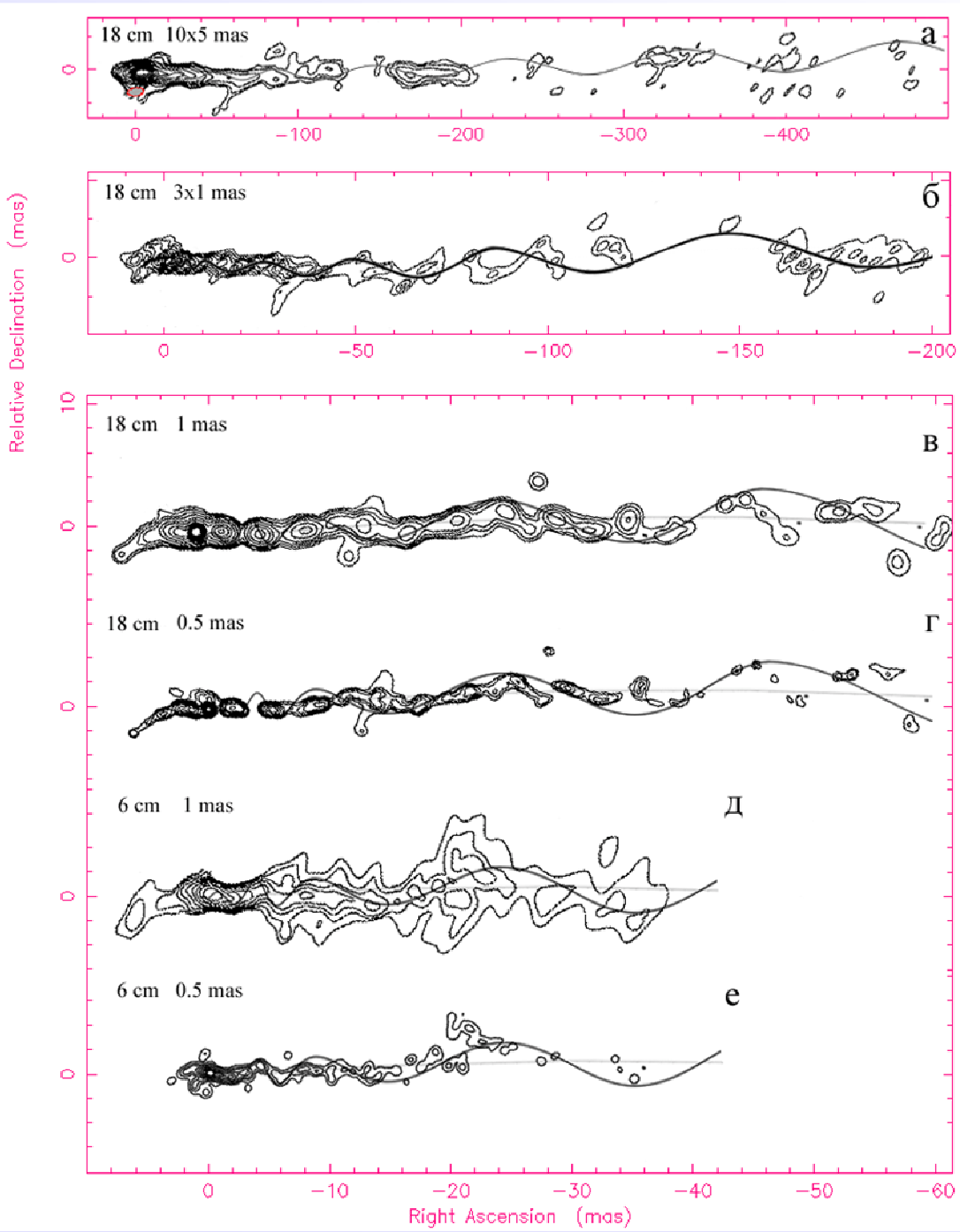
λ=0.7 cm, $T_{b\ peak}$ = (7-15)x10¹² K

Period T(ρ) and precession angular velocity Ω (ρ)



Orientation of jet axis





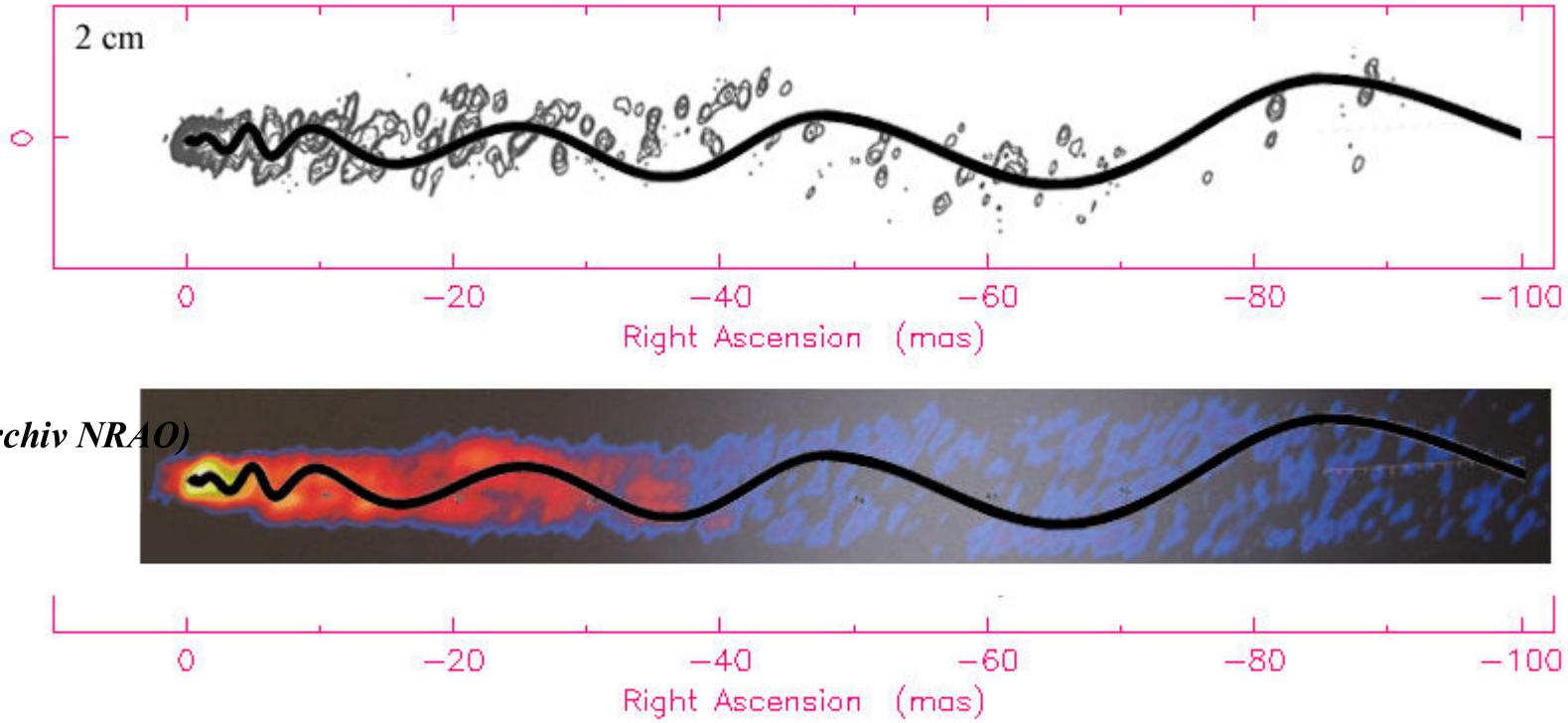
Radiogalaxy M 87

Jet structure
conical helix with increasing step and curve axis

Multi modes:

$\Omega_1 / \Omega_2 \approx 70$

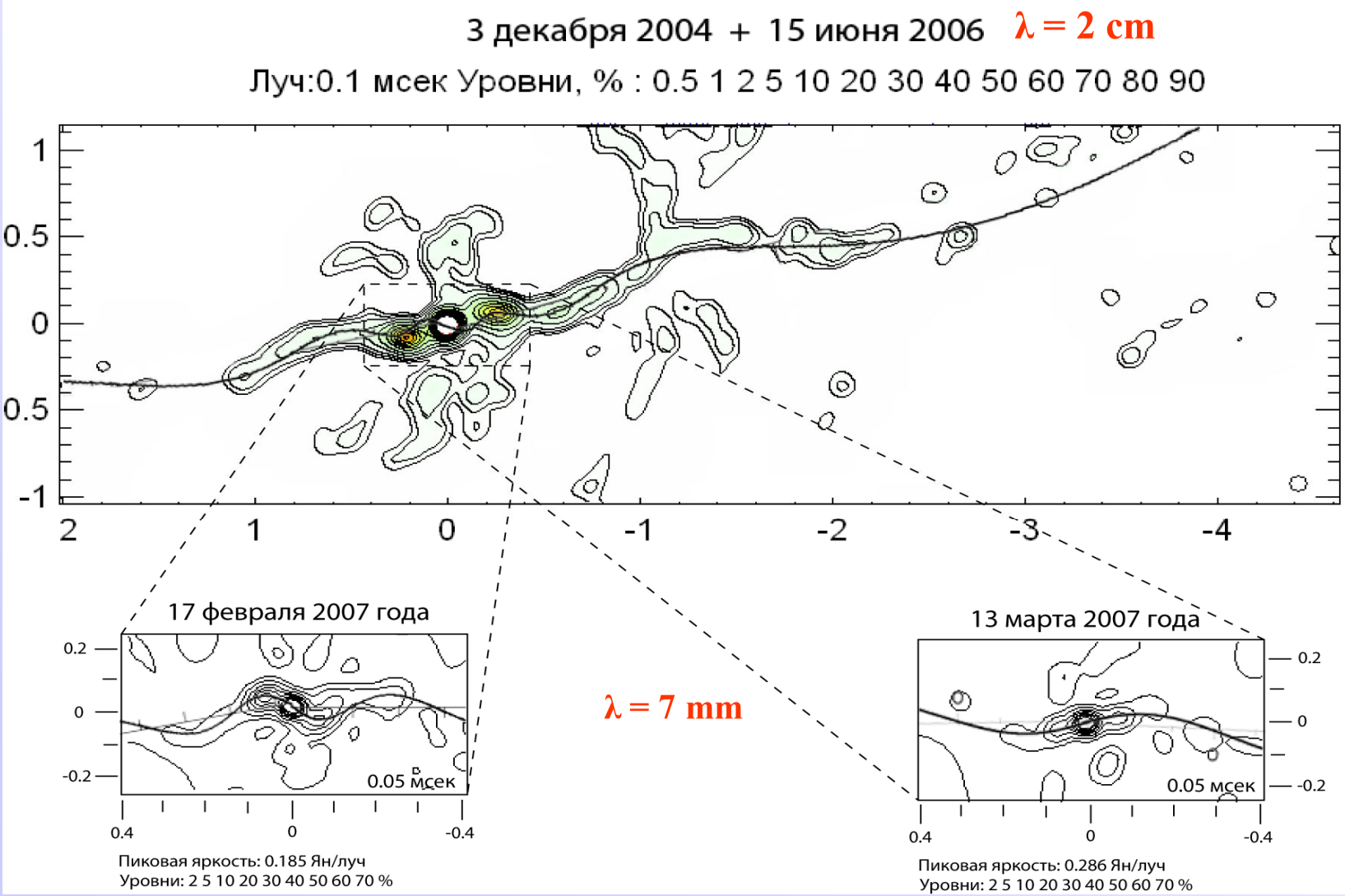
Radiogalaxy M 87



(Archiv NRAO)

(Kovalev Yu.Yu. et al. Ap.J, 2007, 668, 271)

Radiogalaxy M 87

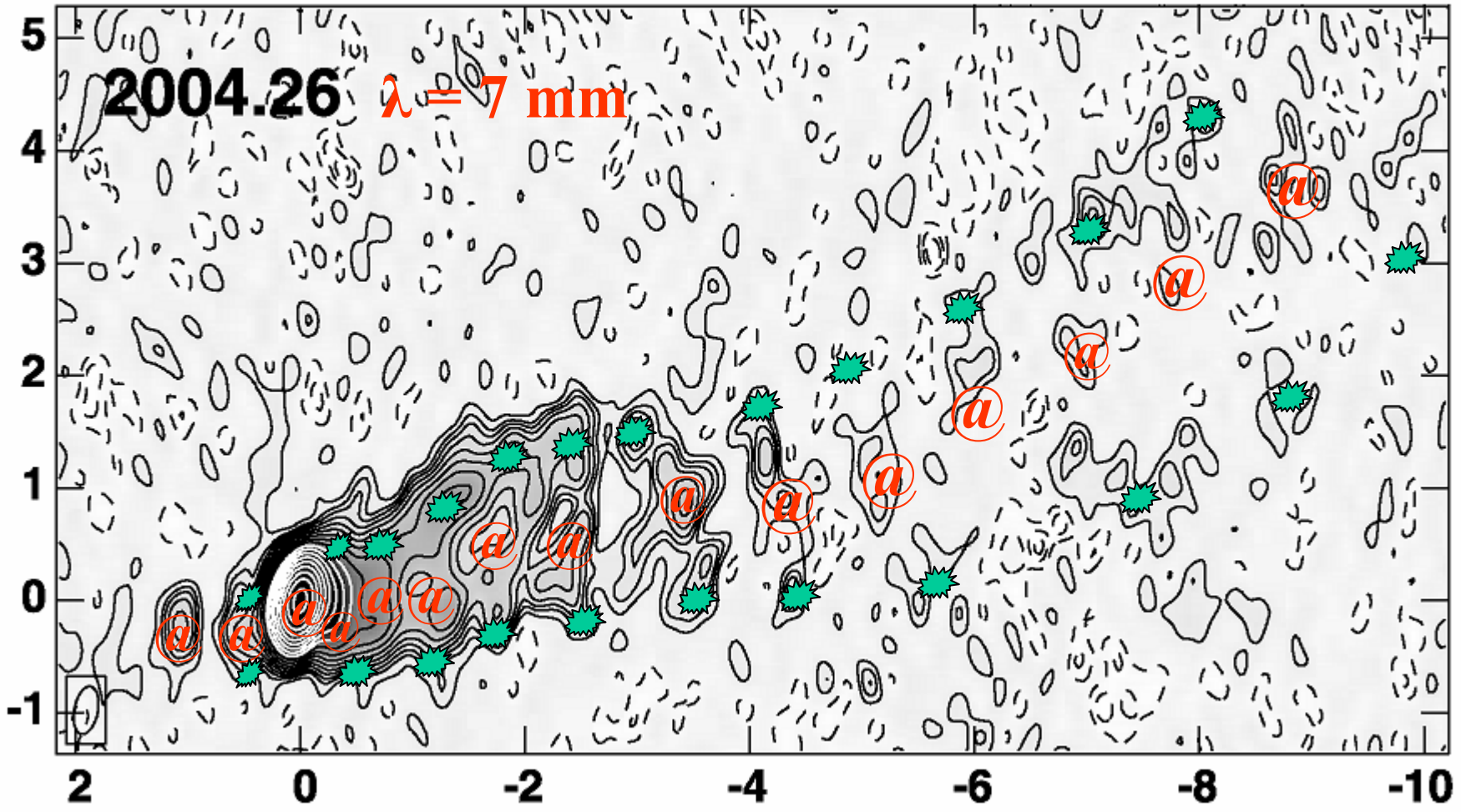


@@@ - high velocity outflow relativistic plasma, big step of helix

. - low velocity outflow quasy relativistic plasma, small step

Countr jet

High velocity jet ≈ 5 low velocity

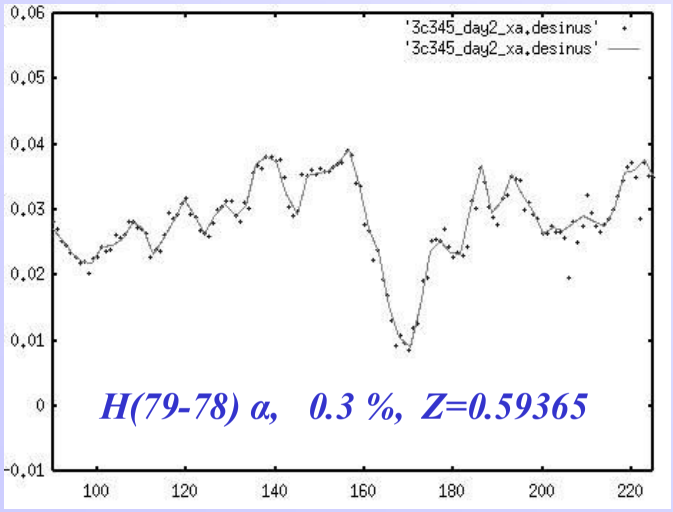


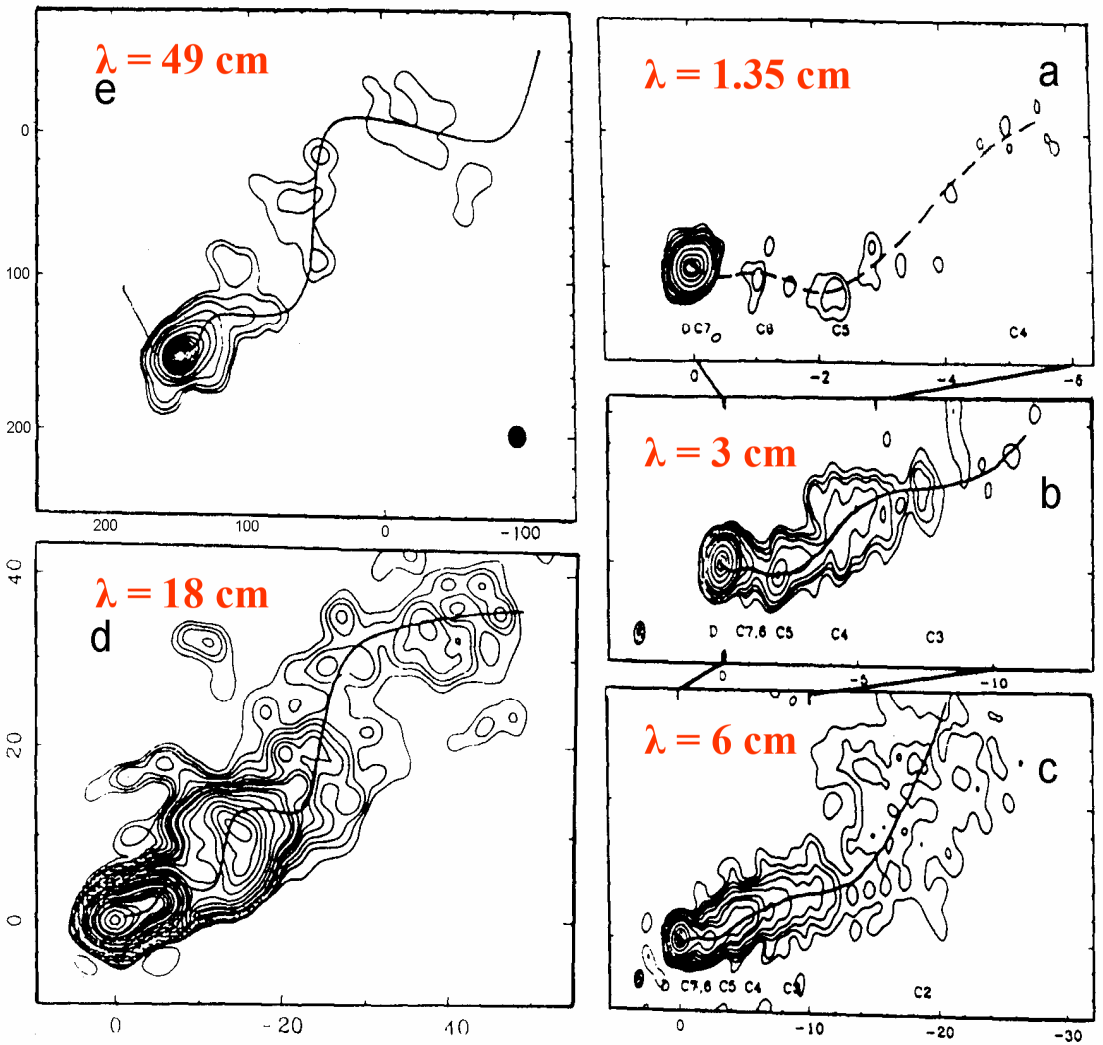
C. Ly at al. 2007, ApJ, 660, 200

QSS 3C 345

• **Multi modes precession $\Omega_2 / \Omega_1 \approx 30$**

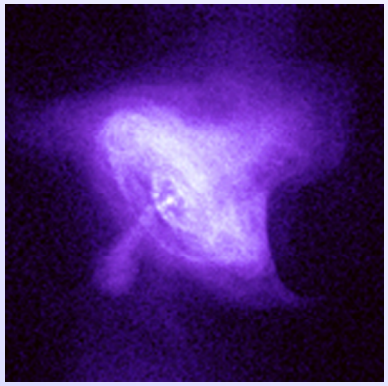
H(79-78)α, 0.3 %, Z=0.59365
Absorption,
radio recombination lines
at the 3 cm band

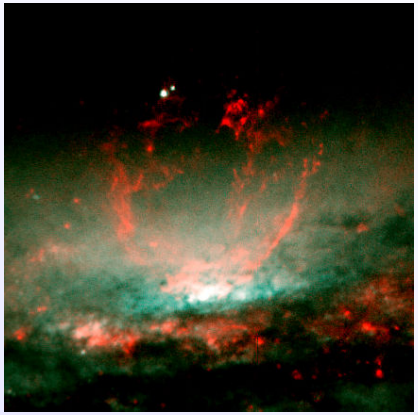


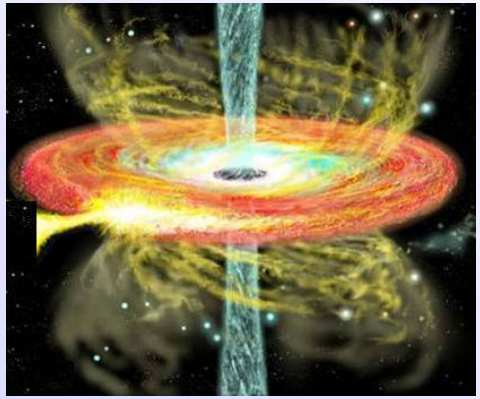


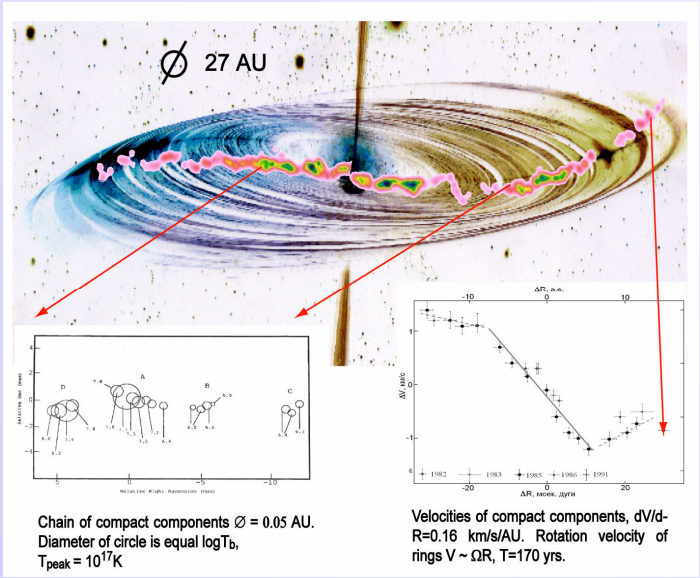
What is it ?

Cosmic whirlwind - tornado?



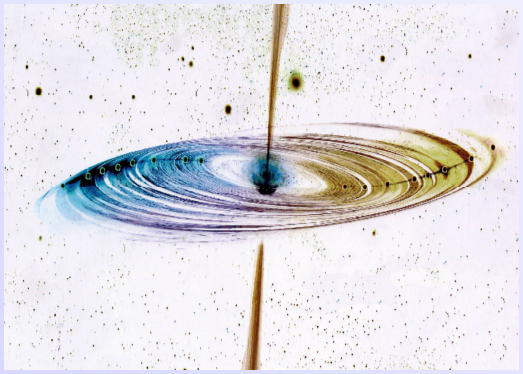


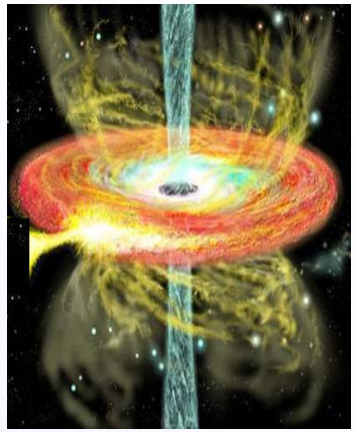




Chain of compact components ∅ = 0.05 AU. Diameter of circle is equal logT_b, $T_{peak} = 10^{17}$K

Velocities of compact components, dV/dR=0.16 km/s/AU. Rotation velocity of rings V ~ ΩR, T=170 yrs.





Martin Abramjan

(Astrophysica, 2009, 52, 135).

Hydrodynamic solution

- *Whirlwind ejected rigid body rotation outflows.*
- *External part of outflows interaction with surrounding matter.*
- *Angular momentum of the external part transference to rigid body core (pivot).*
- *Velocity and rotation of the outflow exponentially intensify, collimation.*

- *Central body is producing in the central part and stabilizing the system.*
- *Plasma – current – magnetic field – extra stabilization*