High-resolution ammonia mapping of the protostellar core Cha-MMS1

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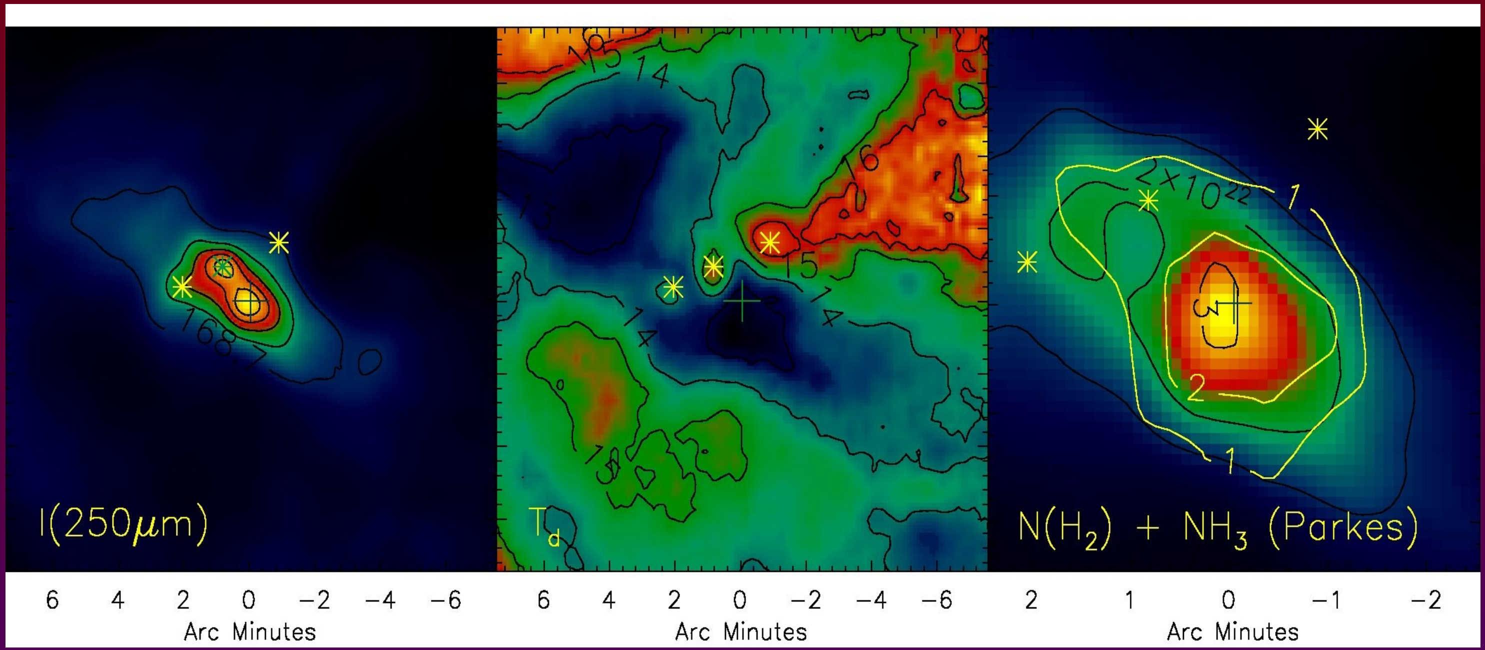
Chamaeleon-MMS1



- Cha-MMS1 is associated with the reflection nebula Cederblad 110.
- Young stellar objects Ced 110 IRS2, IRS4 and IRS6 located nearby.
- Cha-MMS1 is suggested to represent a first hydrostatic core.

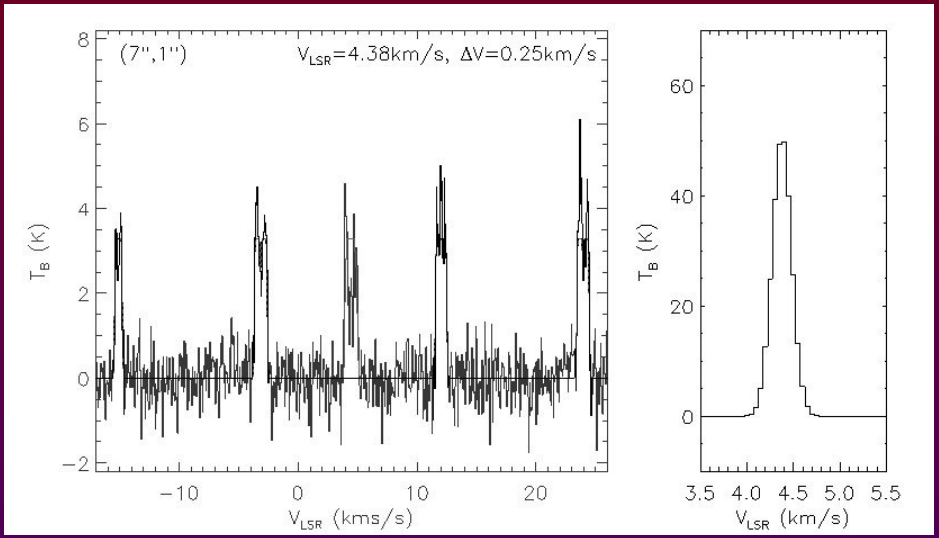
Observations

- Parkes and ATCA observations of NH_3 at λ = 1.2 cm.
- Herschel Science Archive data from SPIRE (500, 350, 250 μm) and PACS (160 70 μm) instruments.

Caption: CSIRO's Parkes radio telescope. Credit: David McClenaghan, CSIRO

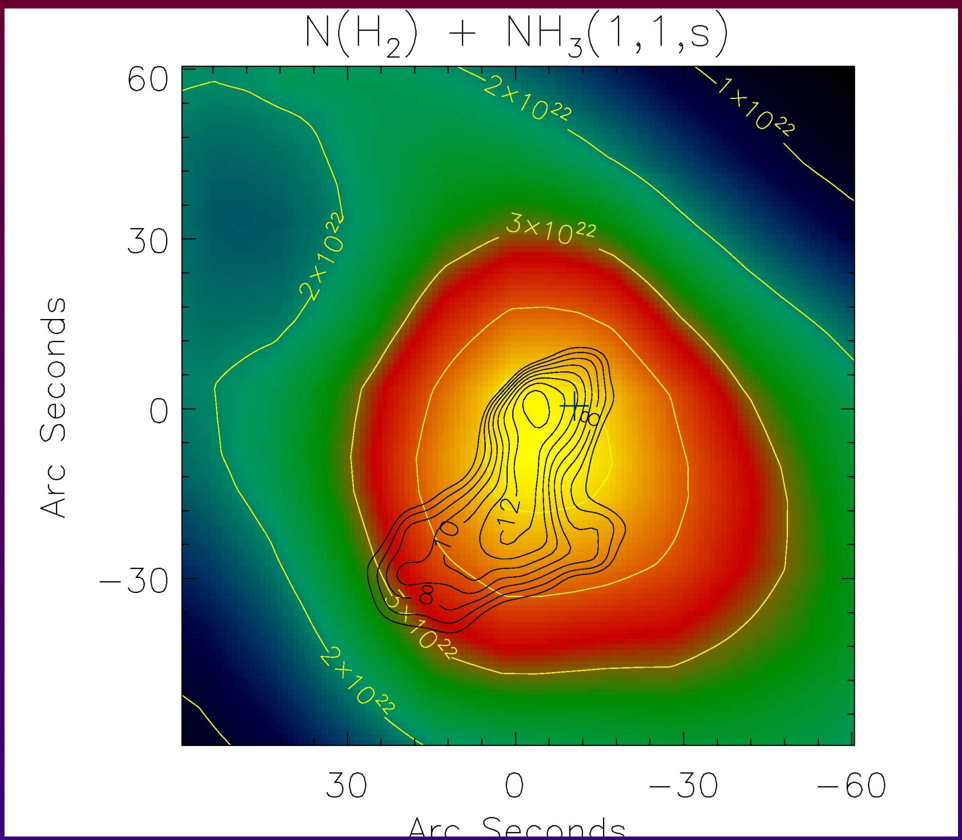
NH_3 observations with ATCA

- NH_3 (1,1) has 18 hyperfine components concentrated on 5 groups.



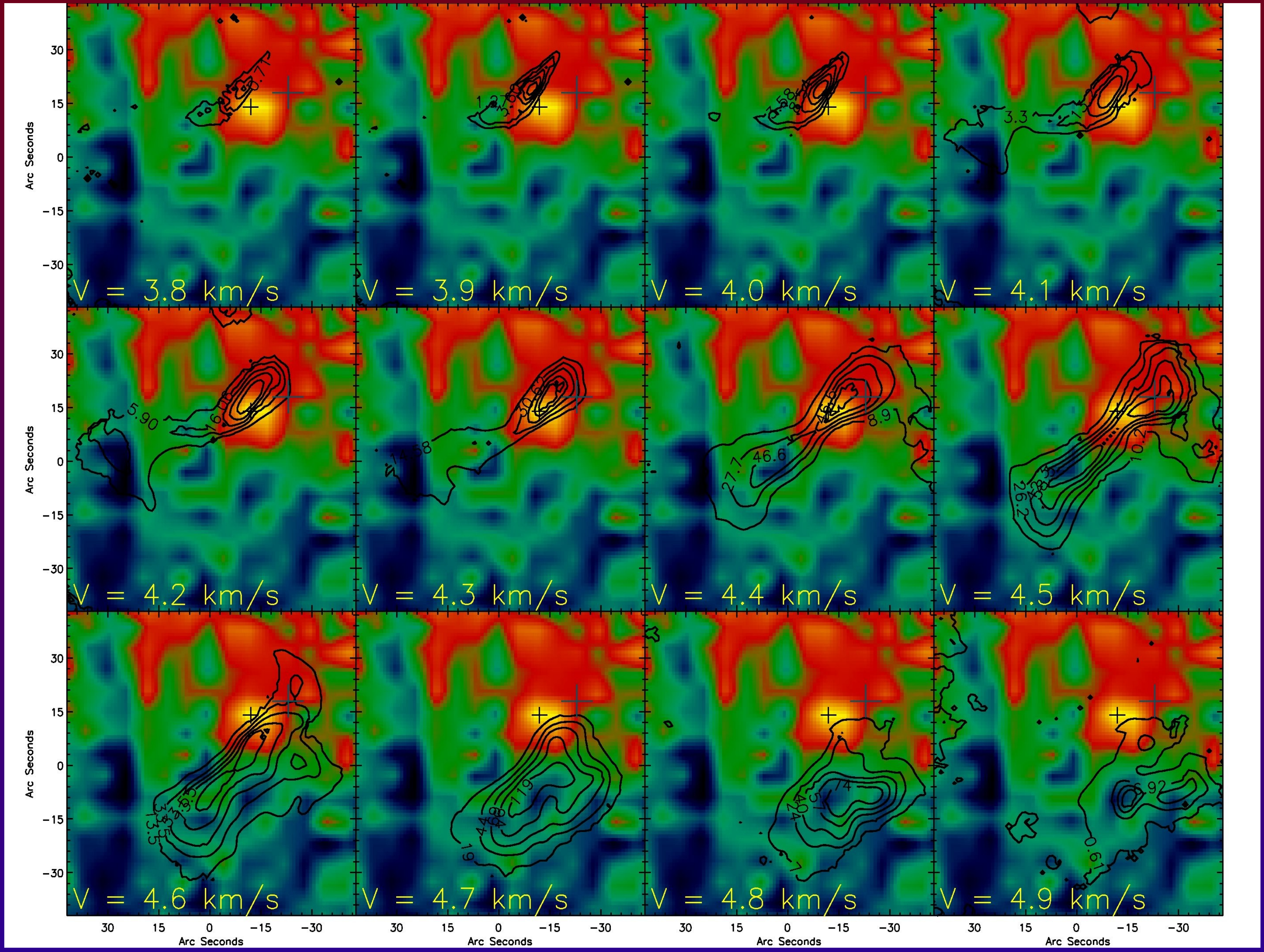
- Main group is optically thick and shown signs of self-absorption. Satellites are less affected by large column densities.
- Gaussian fit was optimized to provide reliable estimates to LSR velocity.

Physical properties of the core

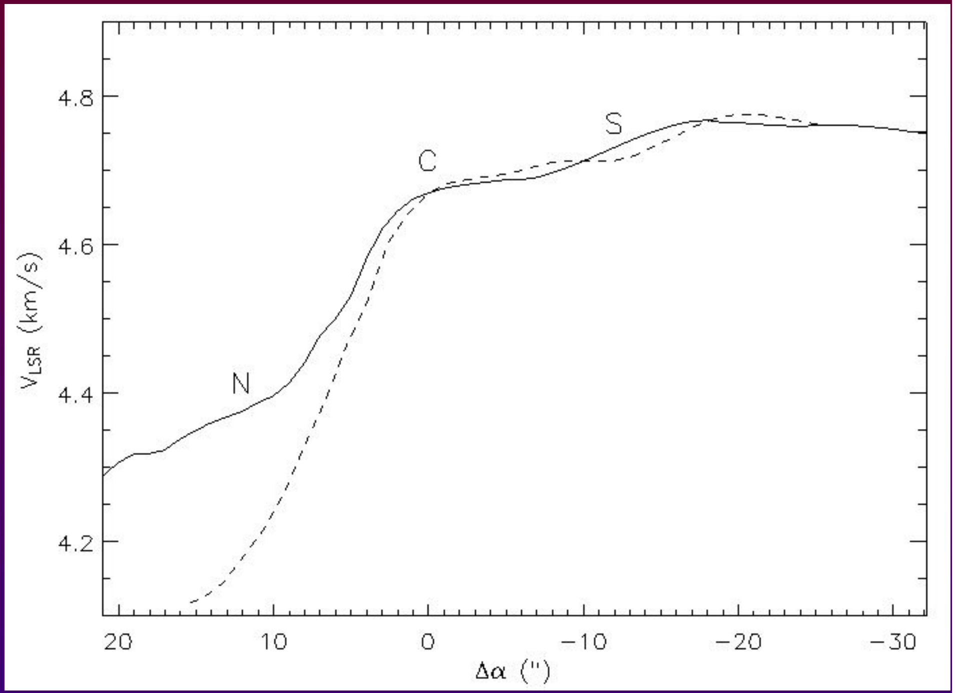


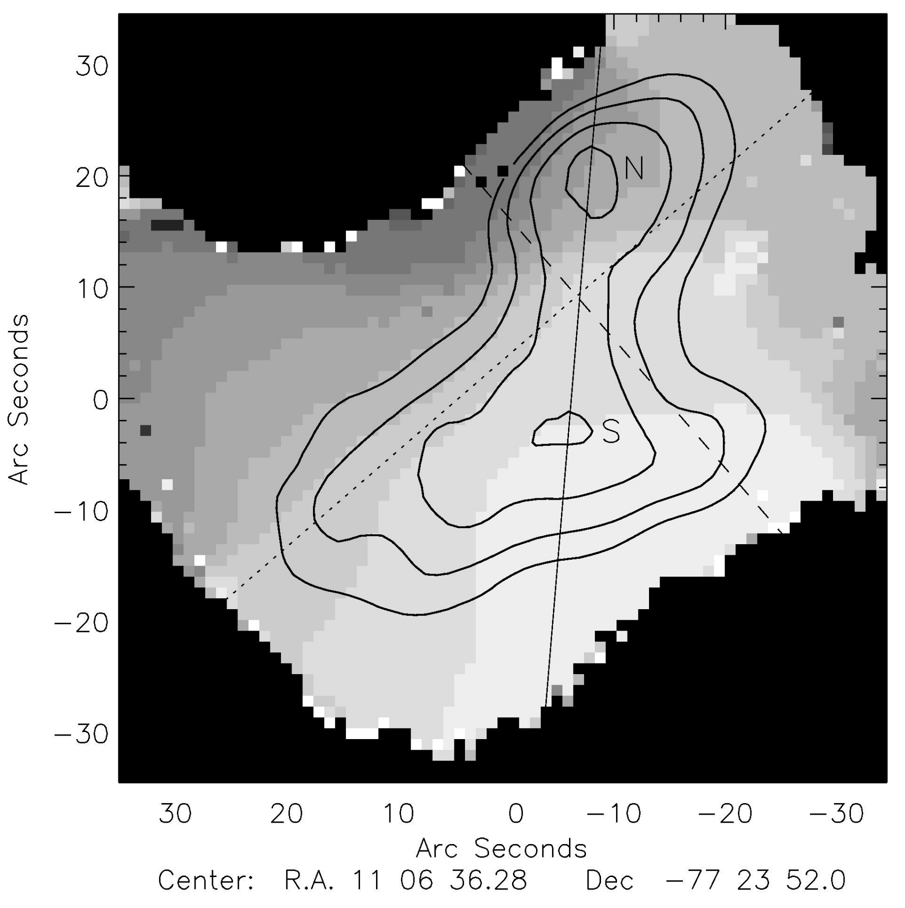
- Gas component is located in the core interior.
- Density is an order of magnitude higher than critical density.
- T_{kin} ~ 10 K
- Mass ~ 0.8 M_{sun}

Velocity channel maps $NH_3(1,1)$



Velocity gradient





Influence from IRS4 outflow

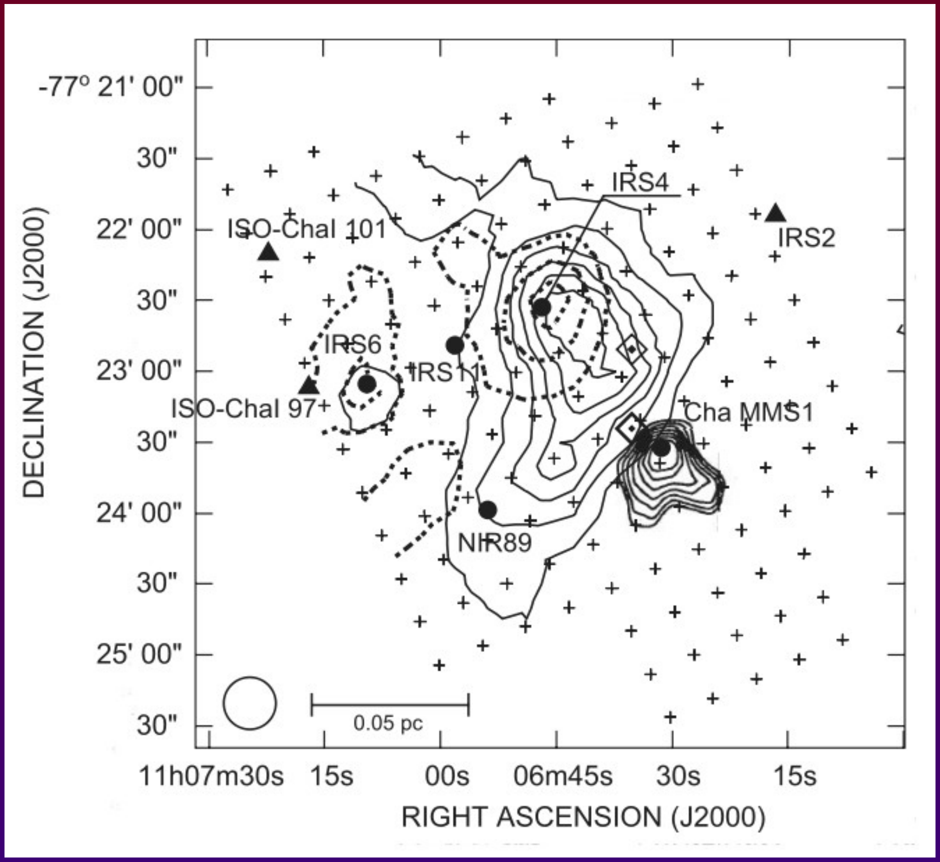


Image from Hiramatsu et al. (2007)

- Hiramatsu et al. (2007) and Ladd et al. (2011) suggest that an outflow from IRS4 collides with Cha-MMS1.
- Momentum input could compress the Cha-MMS1 core.

Slow molecular outflow?

- According to some models, first hydrostatic core can produce a slow molecular outflow given sufficient rotation.
- Some evidence for these types of outflows have been found in objects L1448 IRS2E, L1451-mm and Per-Bolo 58.

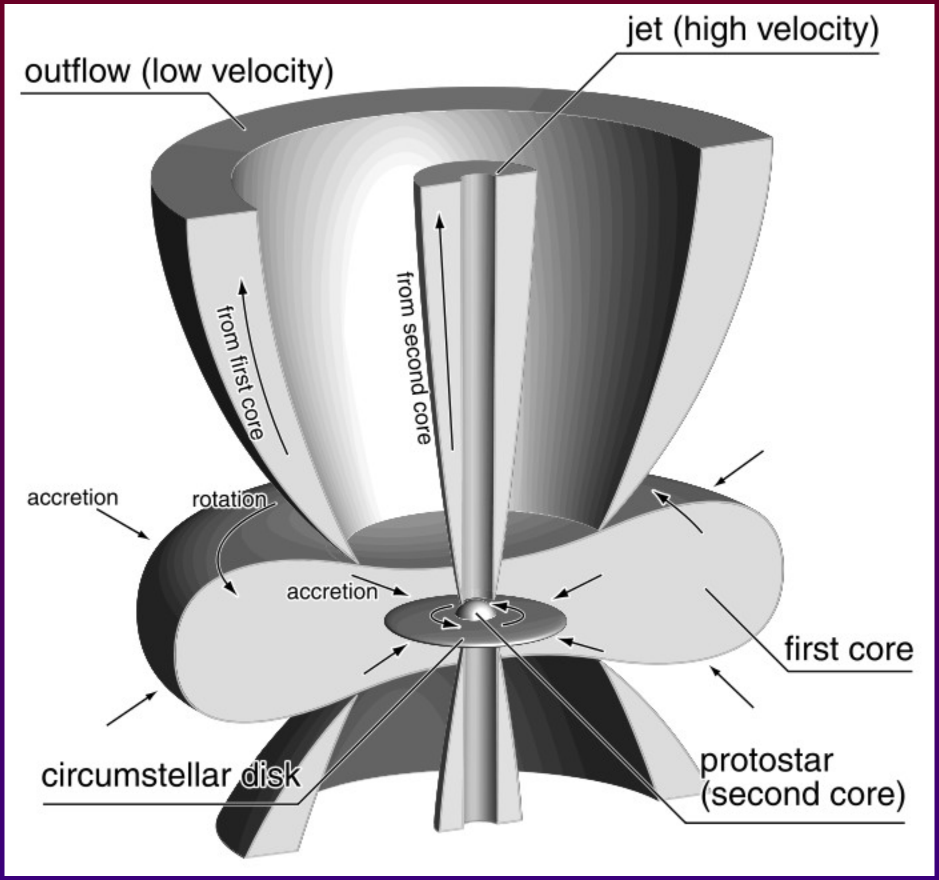
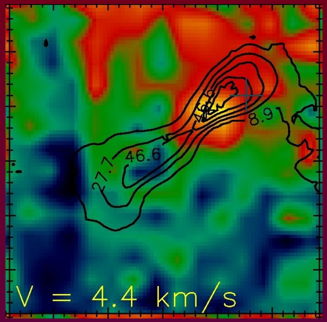
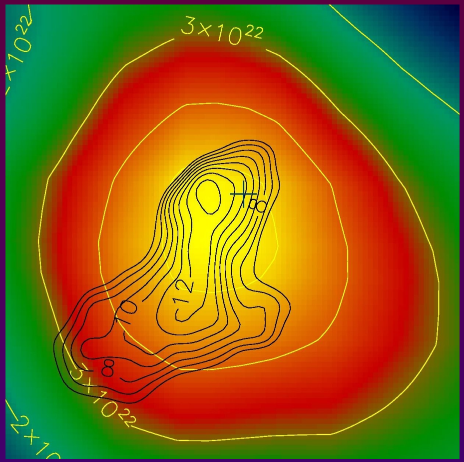


Image from Machida et al. (2008)

Why here?





- Ammonia appears as if moving out of the core.
- Ammonia has an hourglass shape at ~ 4.5 km/s.
- If an outflow is present, it is probably disturbed by other influences.
- We might be totally wrong. More high-resolution studies are required.

Thank you for listening!

Questions?