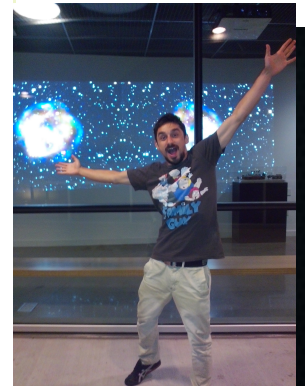
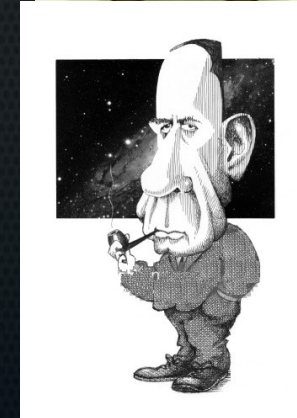
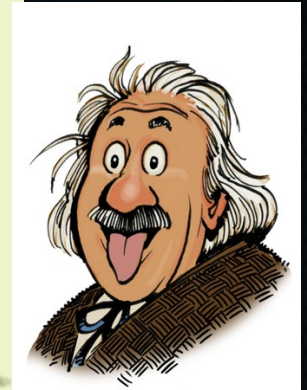
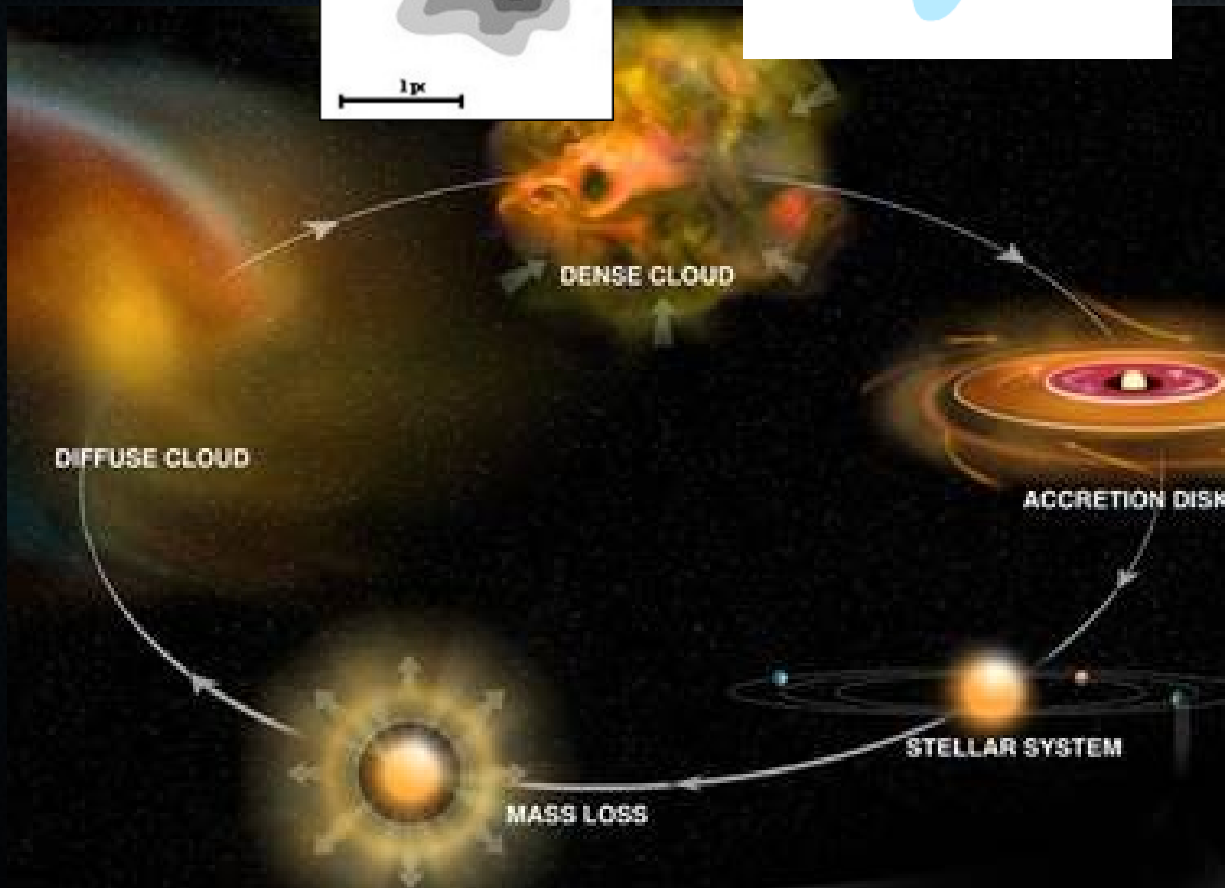
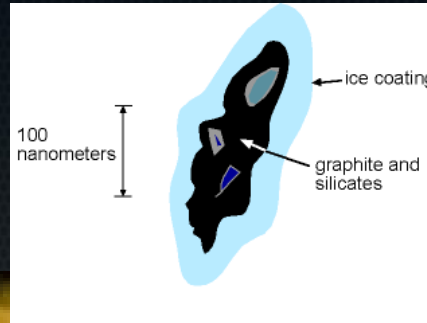
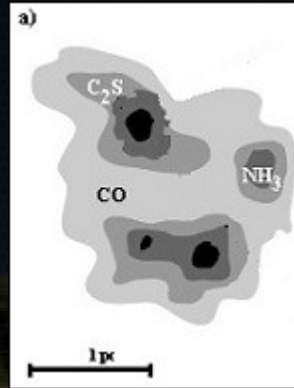


Probing the true shape of prestellar cores with interstellar chemistry

A. Tritsis, K. Tassis, K. Willacy

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What are prestellar cores and why do we care about their shapes?



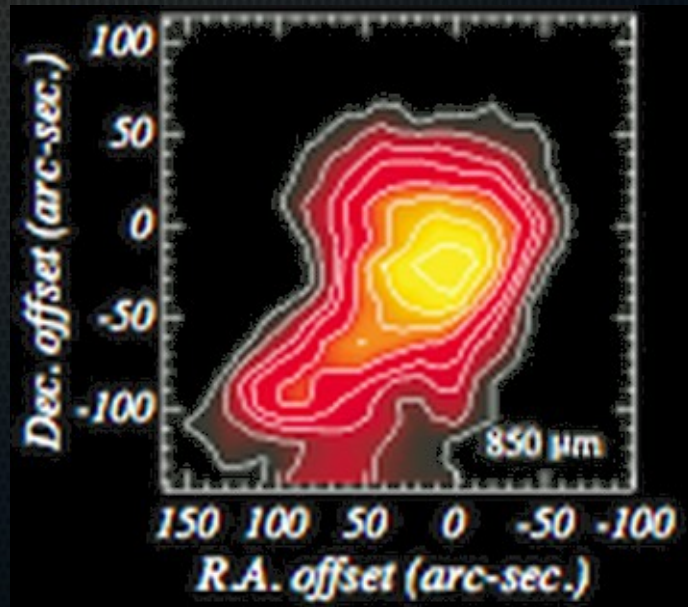
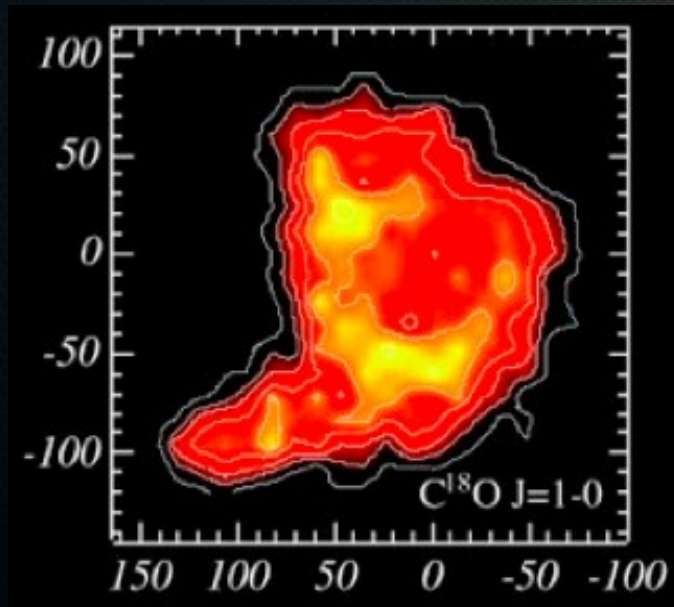
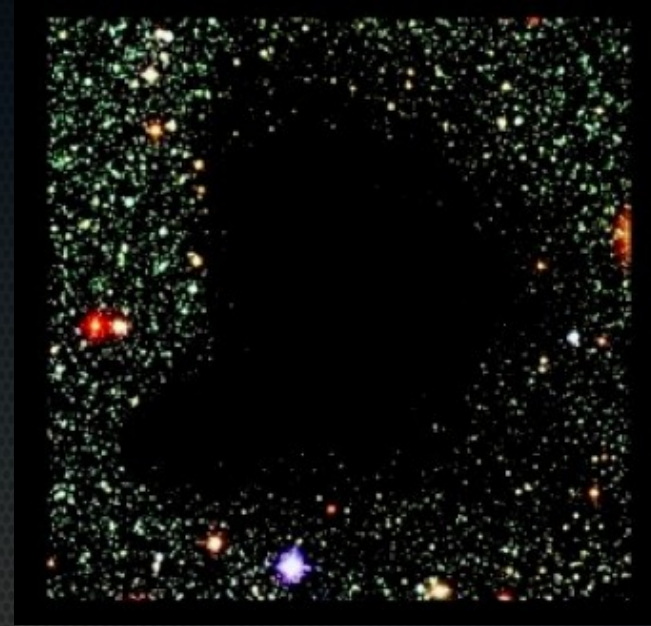
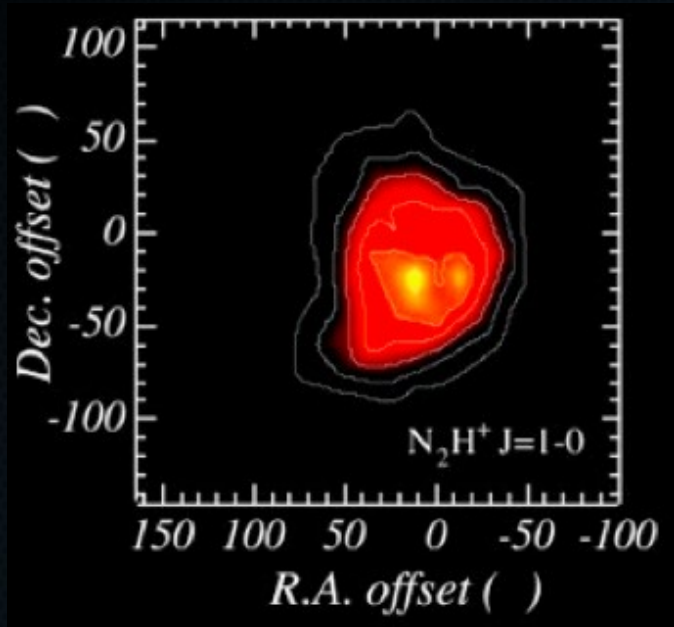
Credit: Bill Saxton NRAO/AUI/NSF

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So what can we learn from interstellar chemistry?

- Temperature (dust)
- Kinematics
- Density estimates (dust)
- Magnetic fields (dust)
- Shape (dust)

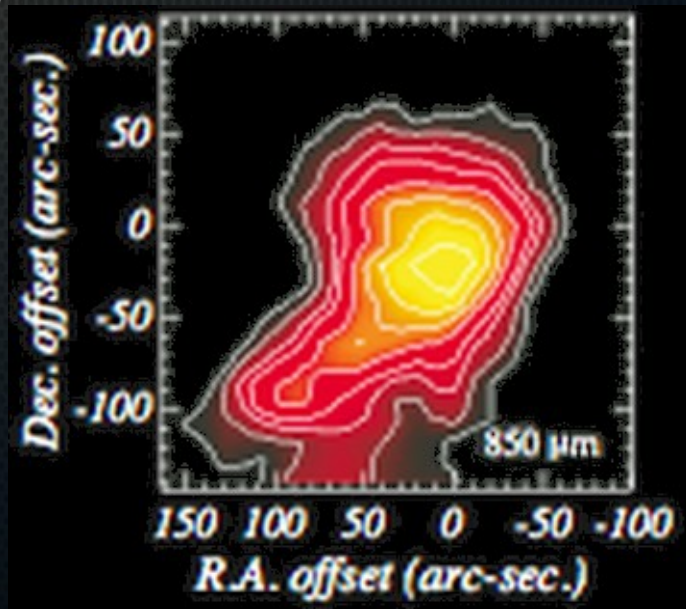
Chemistry vs Dust



Credit: Bergin & Tafalla 2007

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Chemistry vs Dust

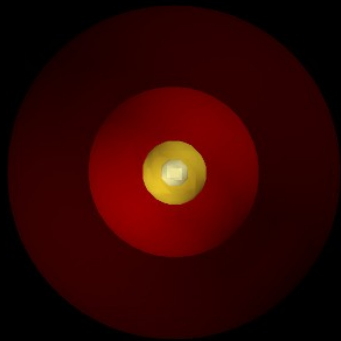


Credit: Bergin & Tafalla 2007

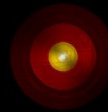
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Projection effect

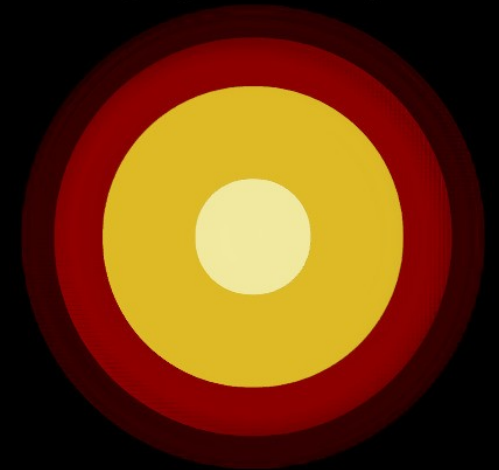
spherical



cylindrical

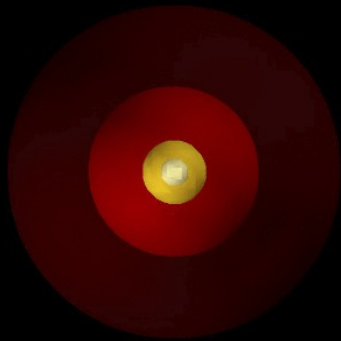


disk-like

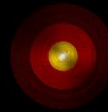


Projection effect

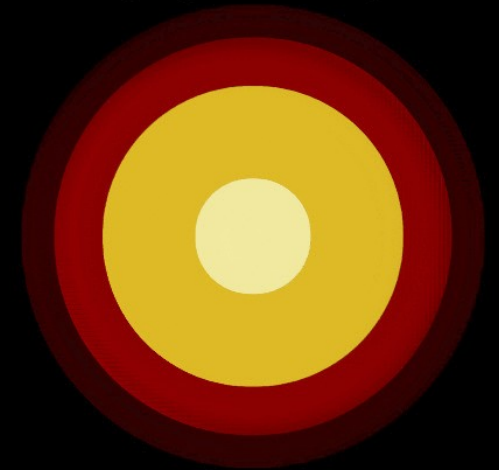
spherical



cylindrical



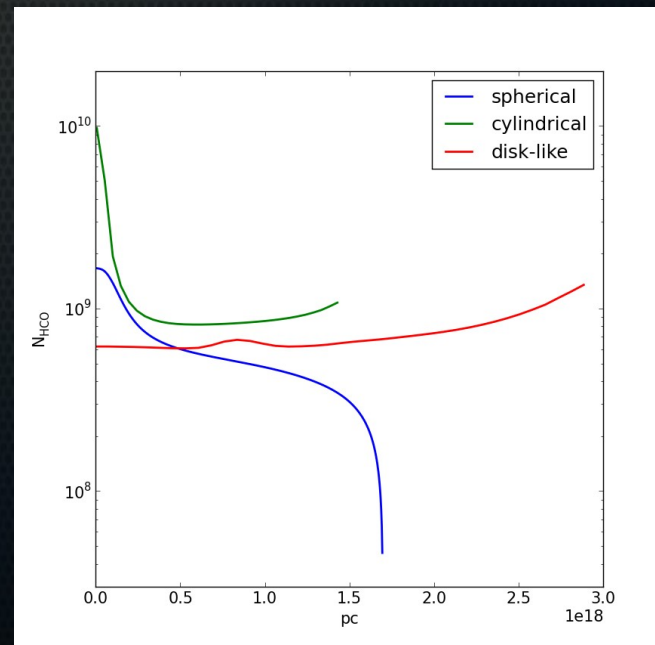
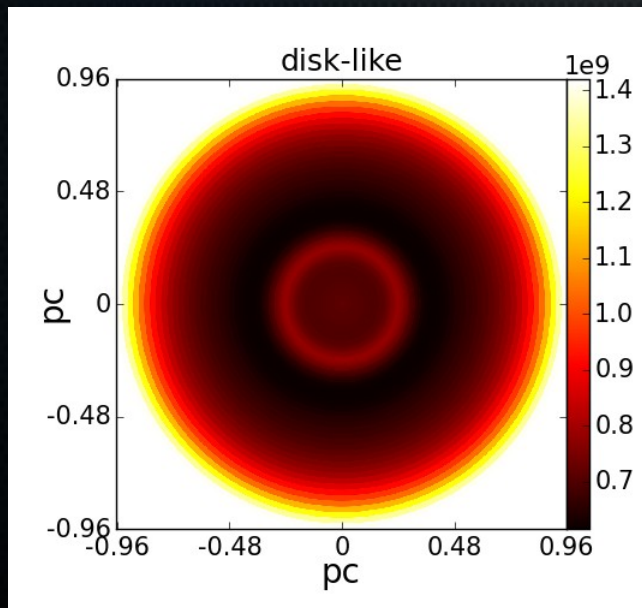
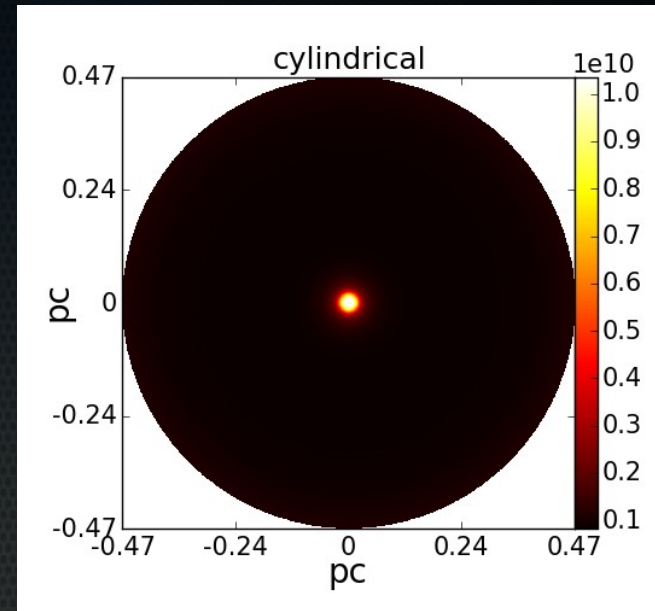
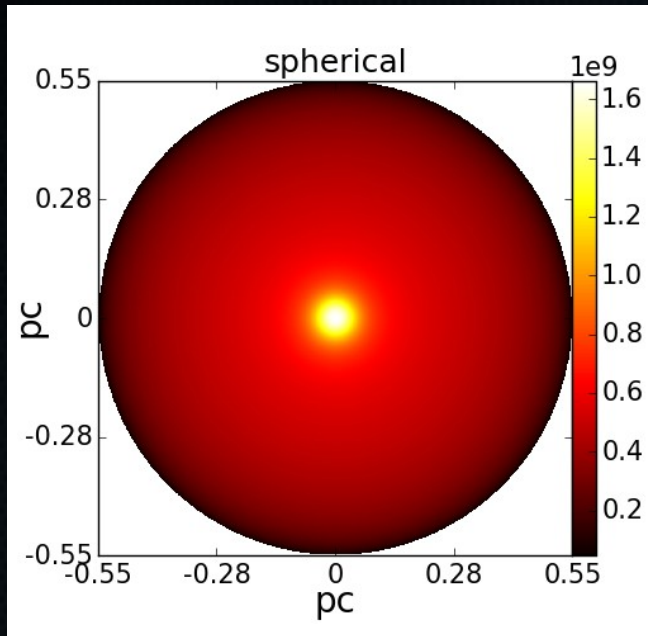
disk-like



Methods

- Hydrodynamical simulations combined with non-equilibrium chemical network (FLASH code)
- Isothermal
- Initial density $\sim 10^3 \text{ cm}^{-3}$
- Isolated
- 296 chemical species governed by 13967 chemical reactions
- Typical values of molecular clouds for the chemical and physical parameters ($T=7\sim 14 \text{ K}$, $\zeta=3.3\cdot 10^{-18} \text{ s}^{-1} \sim 5.2\cdot 10^{-17} \text{ s}^{-1}$)

Face on



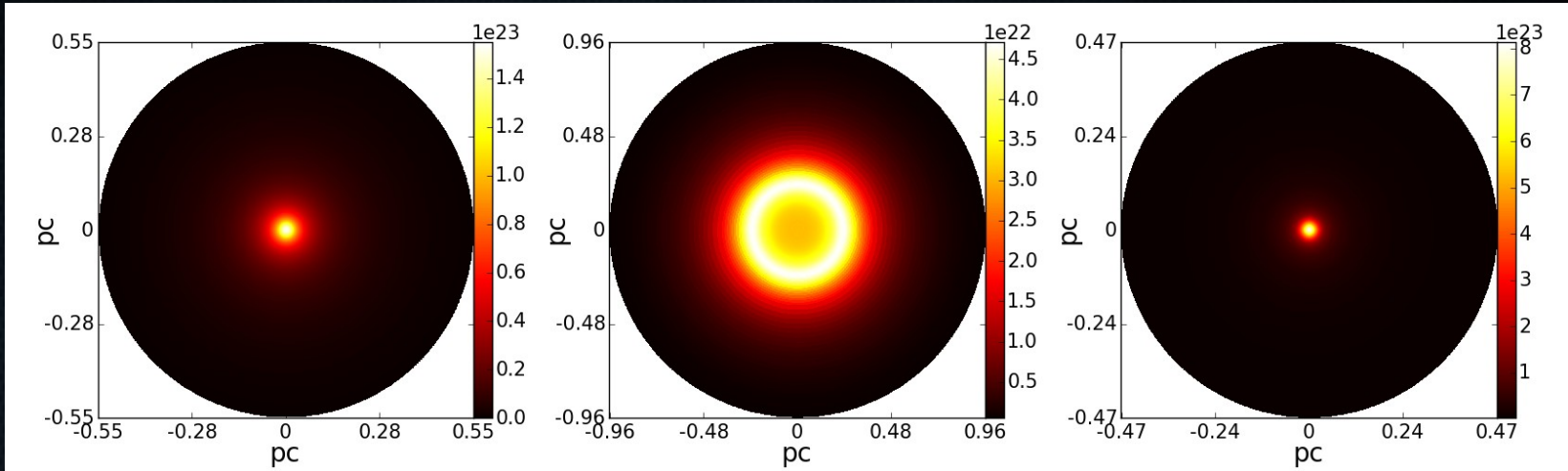
Face on

Spherical

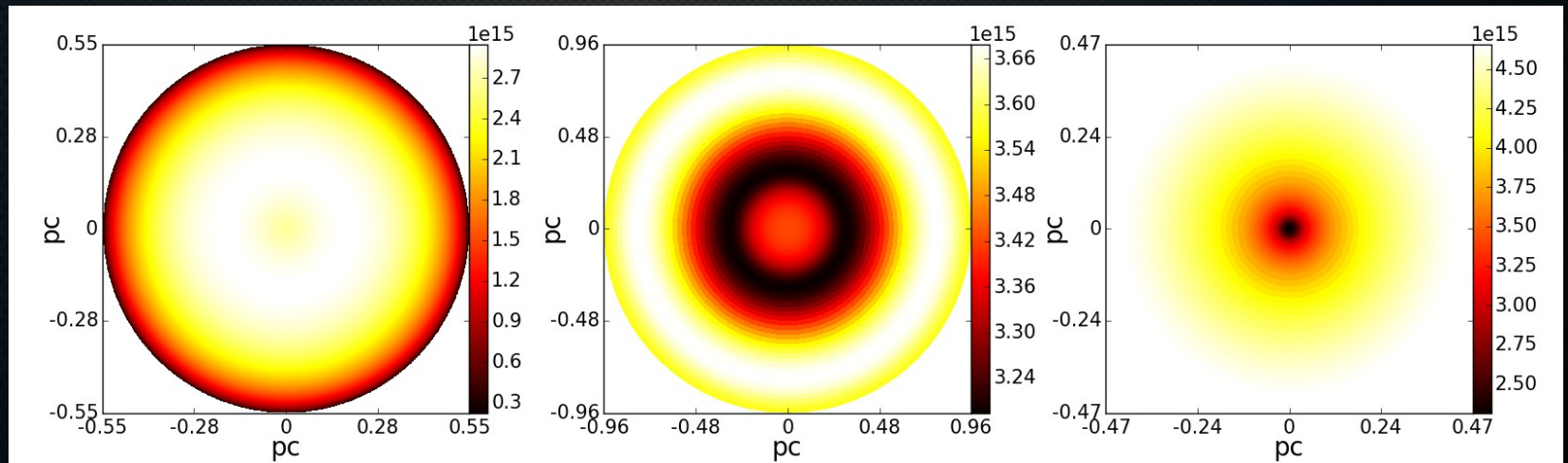
Disk-like

Cylindrical

Total column density



CO column density



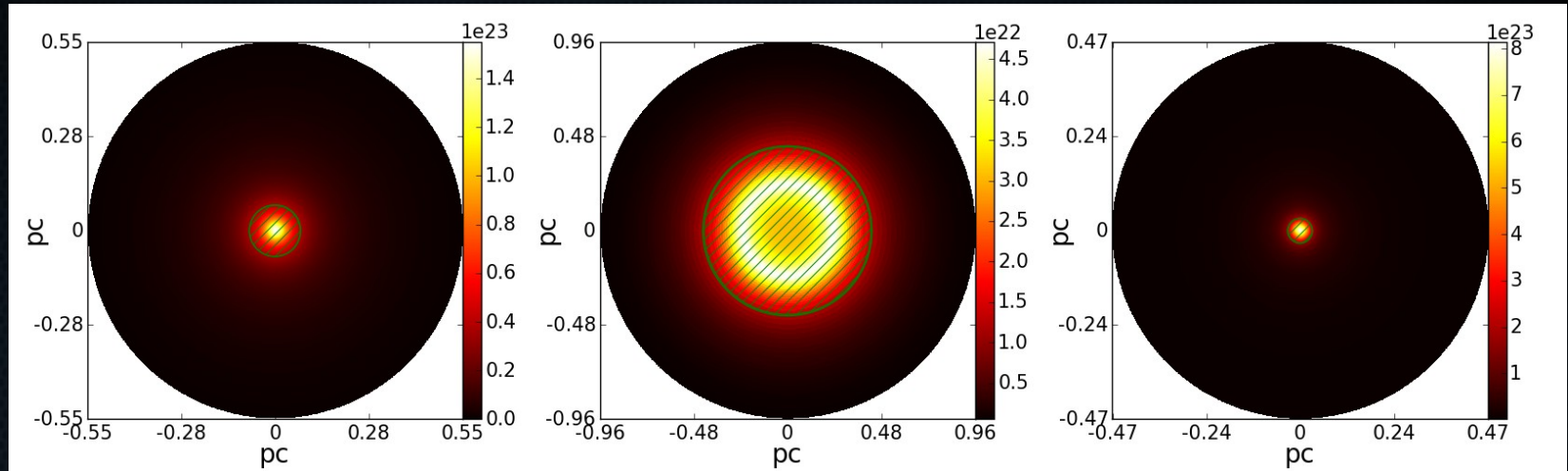
Face on

Spherical

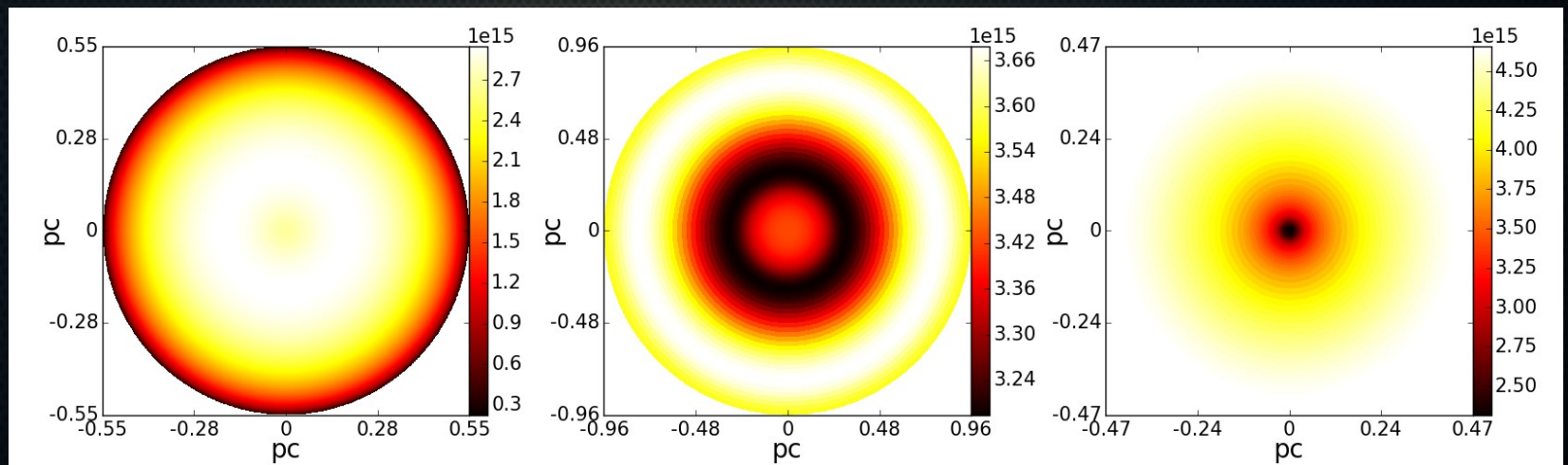
Disk-like

Cylindrical

Total column density



CO column density



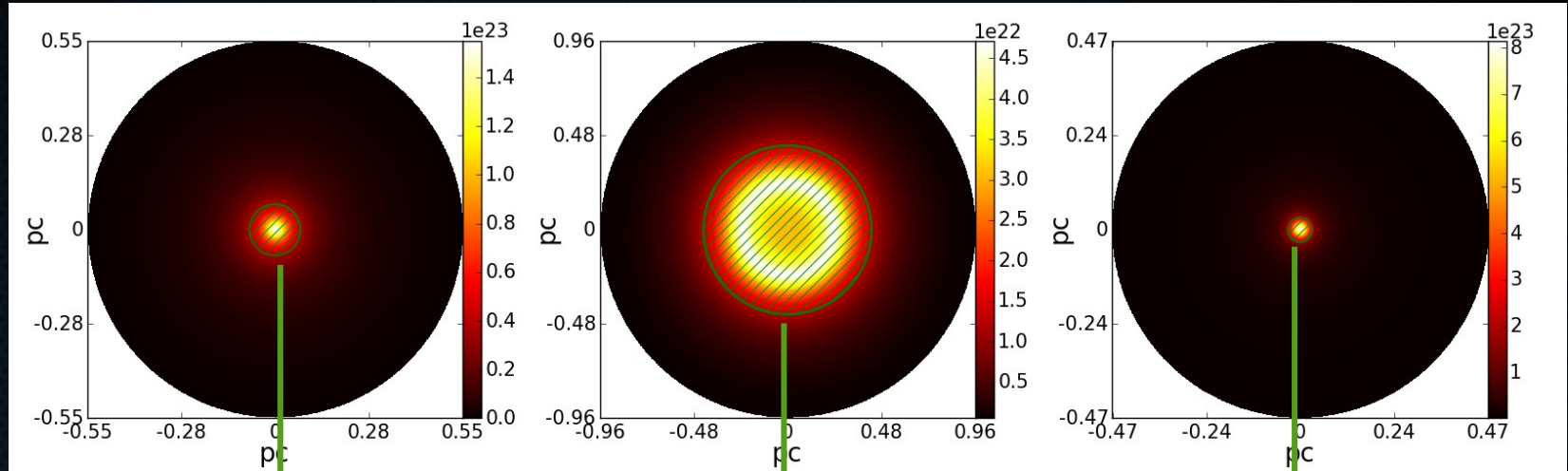
Face on

Spherical

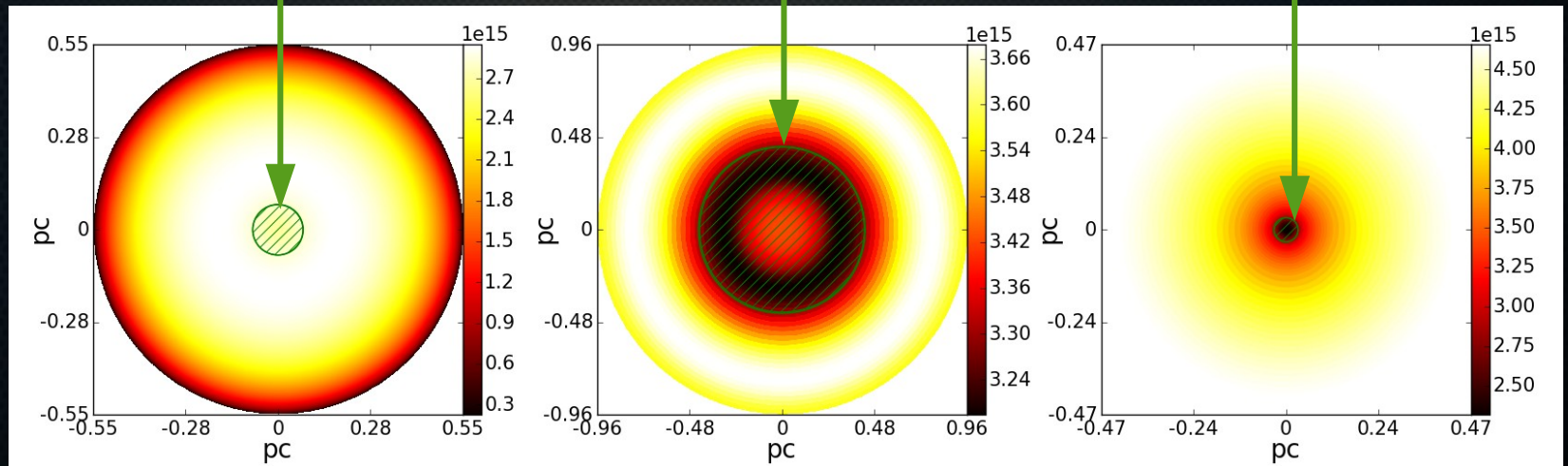
Disk-like

Cylindrical

Total column density

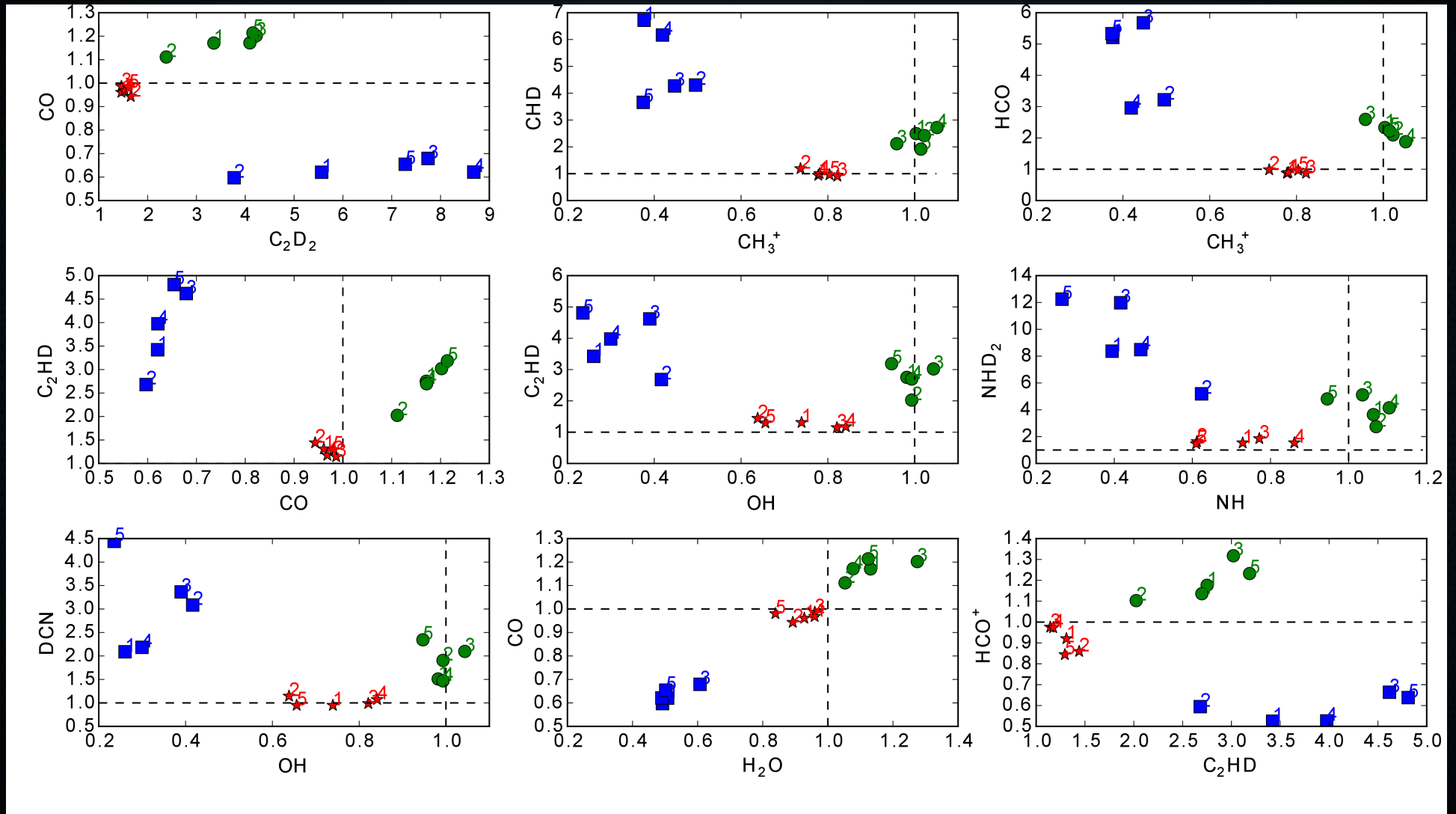


CO column density



$$\Delta = \frac{\overline{N_X} \text{ inside a contour marking 25\% of } N_{H_2}}{\overline{N_X} \text{ over the entire extent of the core}}$$

Face on

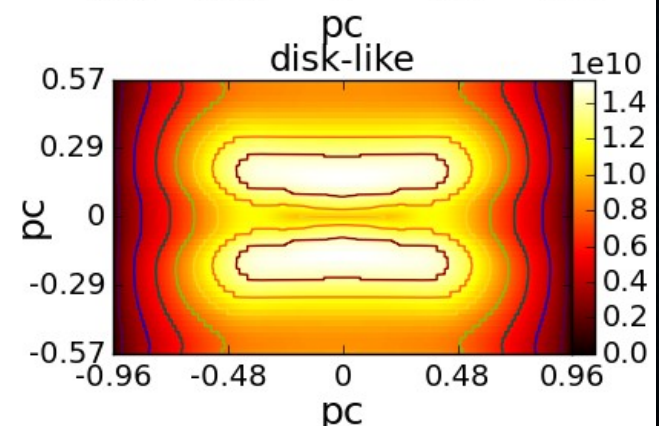
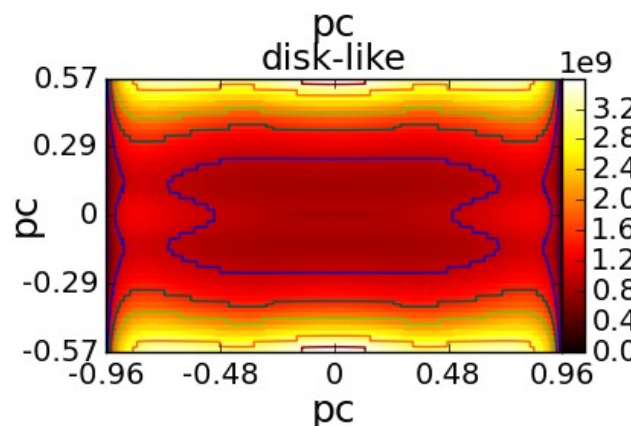
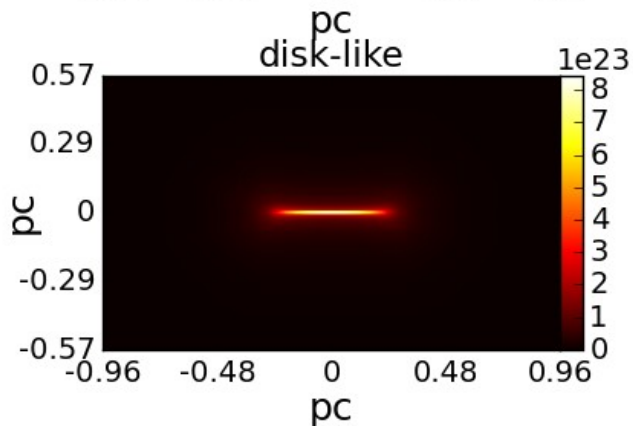
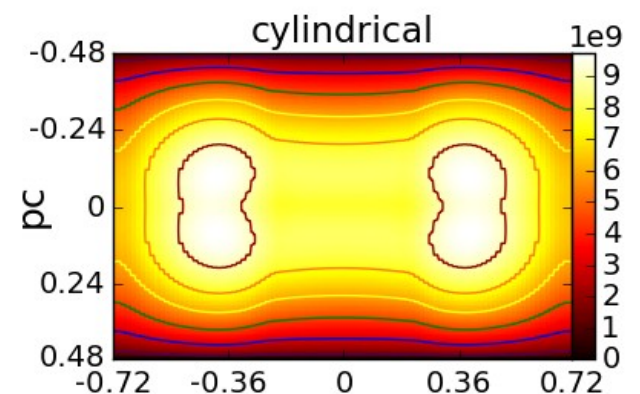
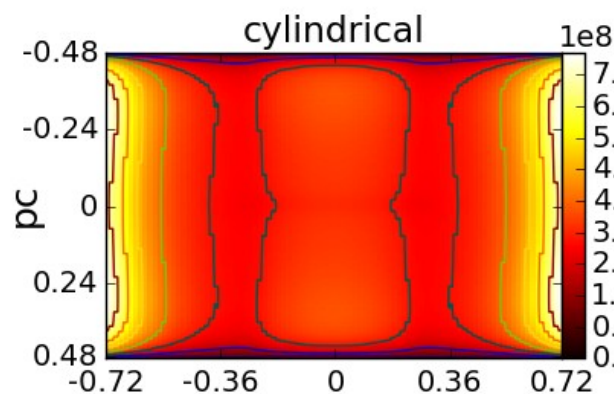
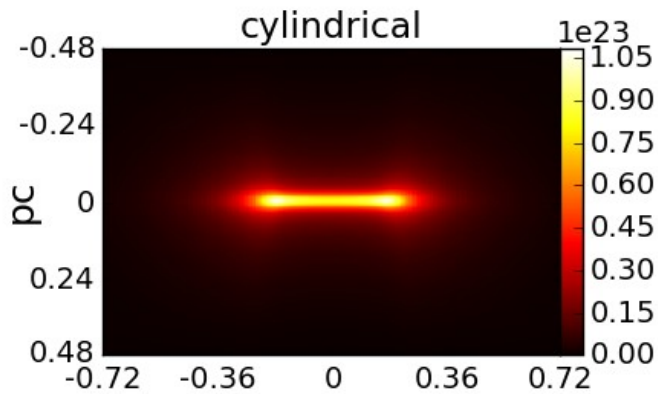


Edge on

Total density

$C_3H_3^+$

N_2H^+

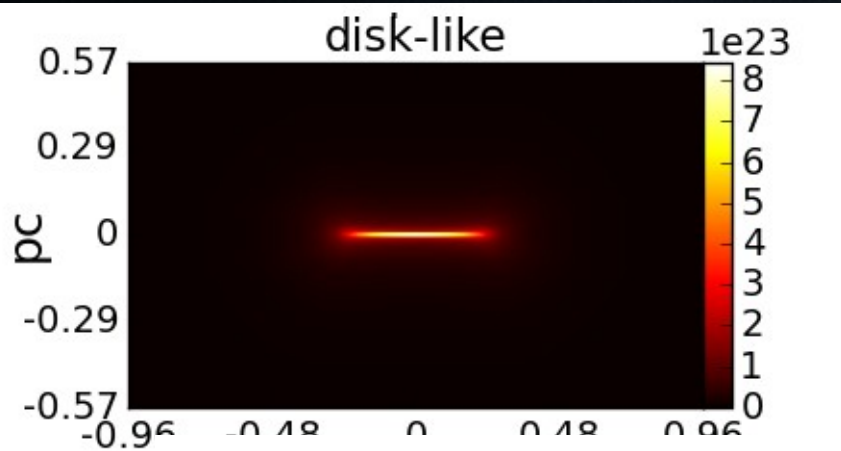


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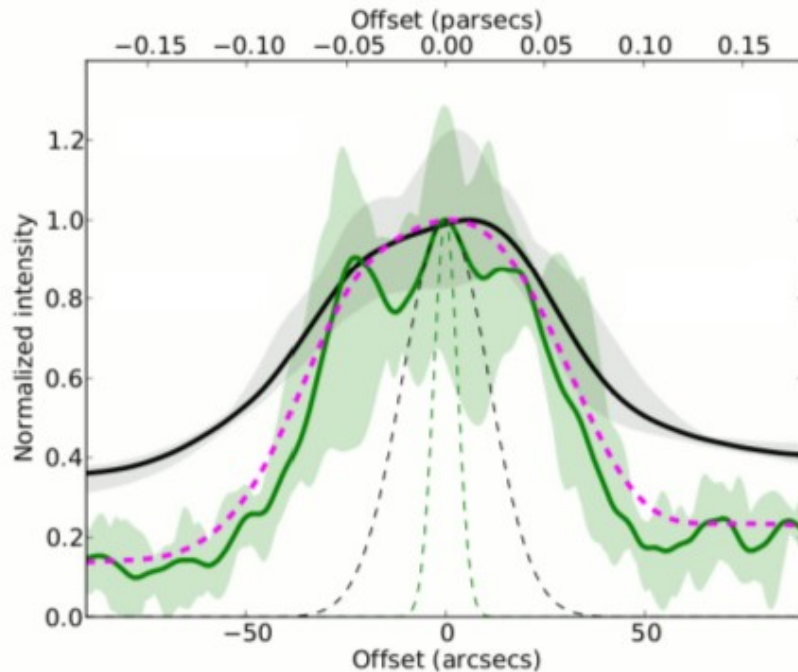
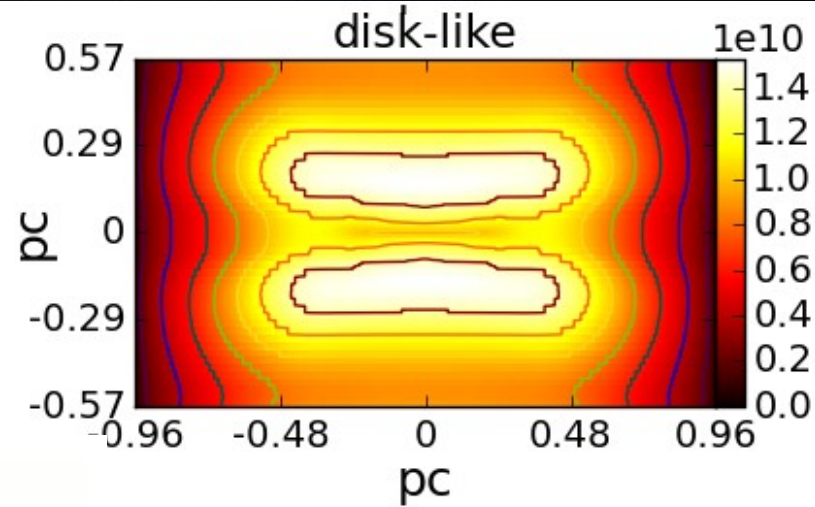
tritsis@physics.uoc.gr

Edge on

Total density



N_2H^+

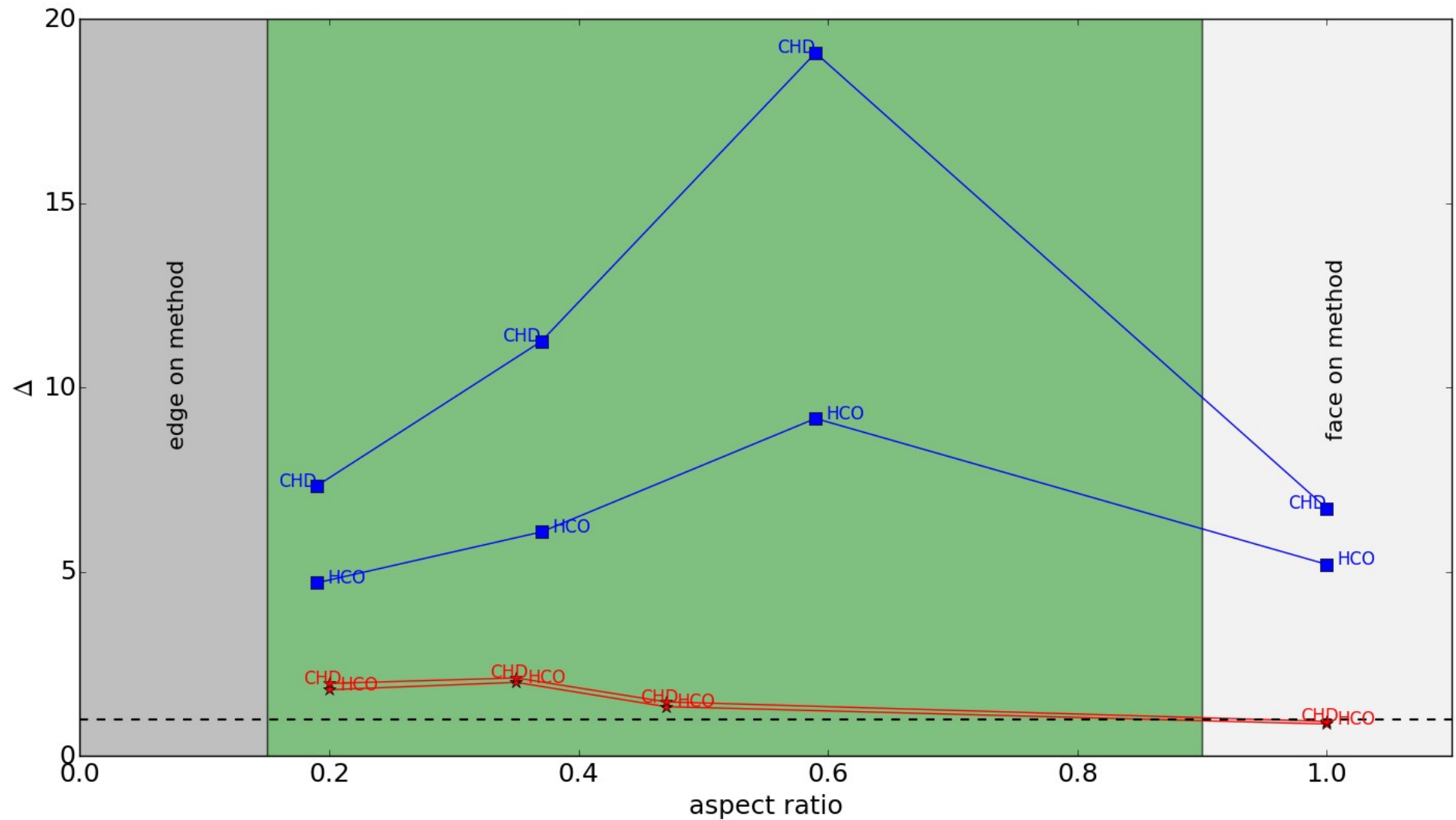


“Single Herschel filaments are composed of two to three narrower N_2H^+ filaments, often positioned quasi-parallel” Fernandez-Lopez et al. (2014)

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Intermediate angles



So what can we learn from interstellar chemistry?

- Temperature (dust)
- Kinematics
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- Shape (dust)



Take home message

- We have a new recipe for probing the true 3D shape of prestellar cores using interstellar chemistry

Thank you for you attention!