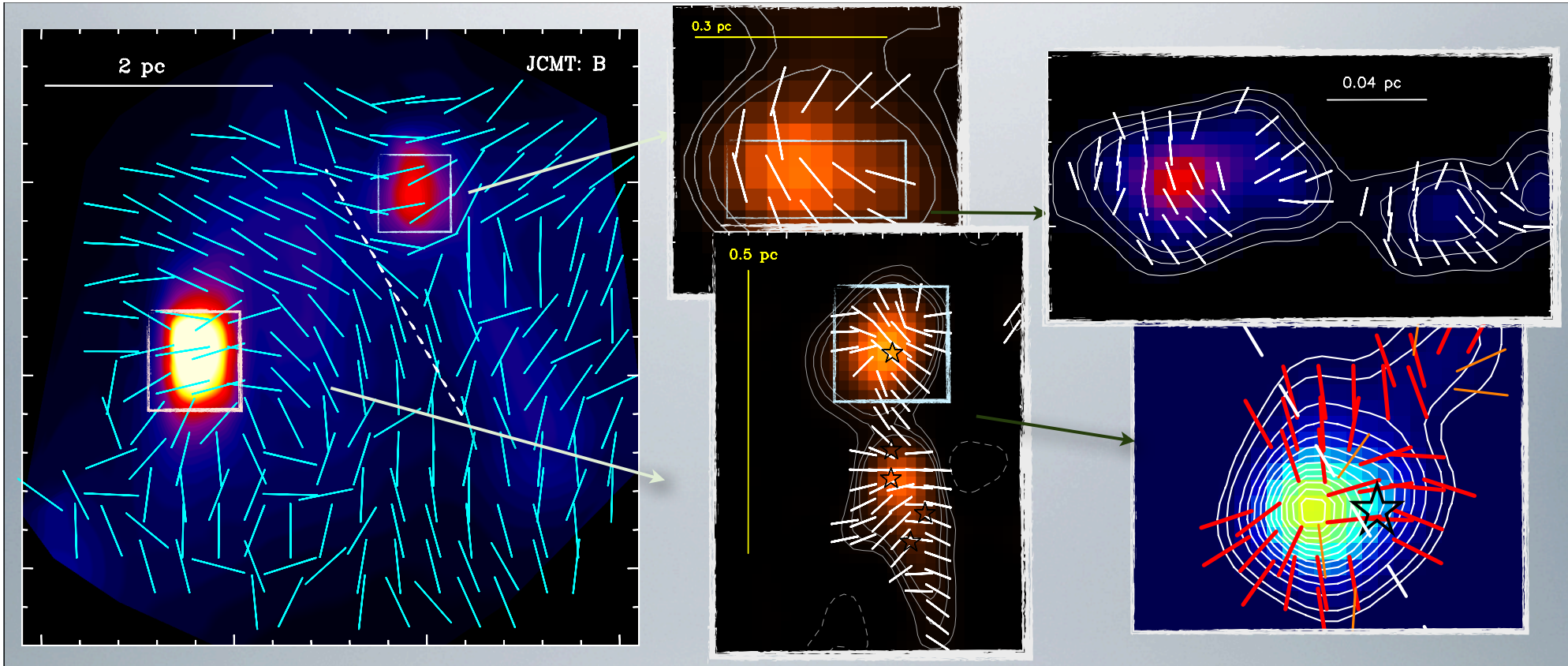


# Submillimeter Polarization and Magnetic Field in Star formation

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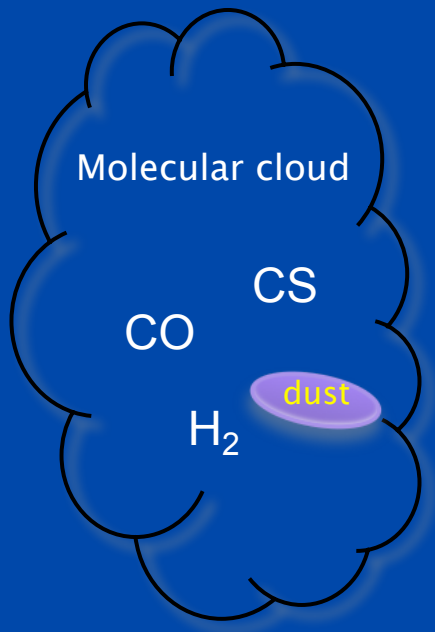
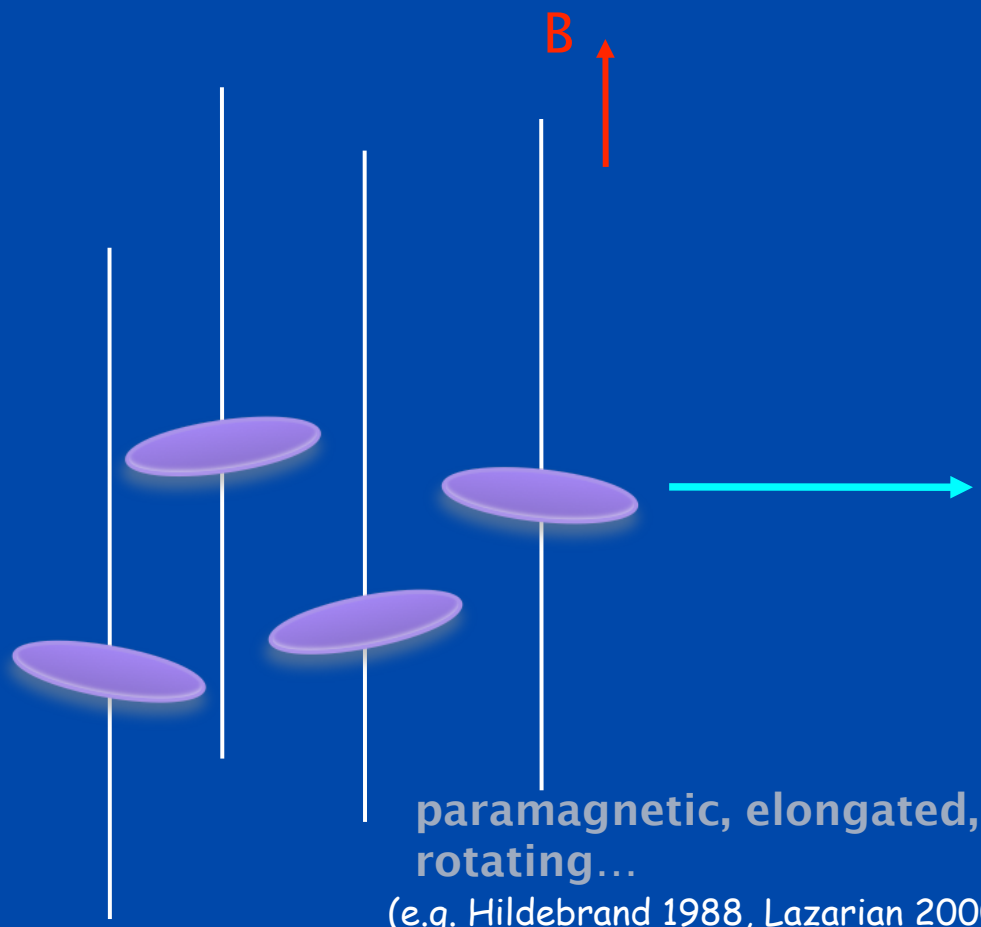
# Dust Polarization Mechanism




$n_{H_2}$ ~ 10 $^{4-7}$ (cm $^{-3}$)

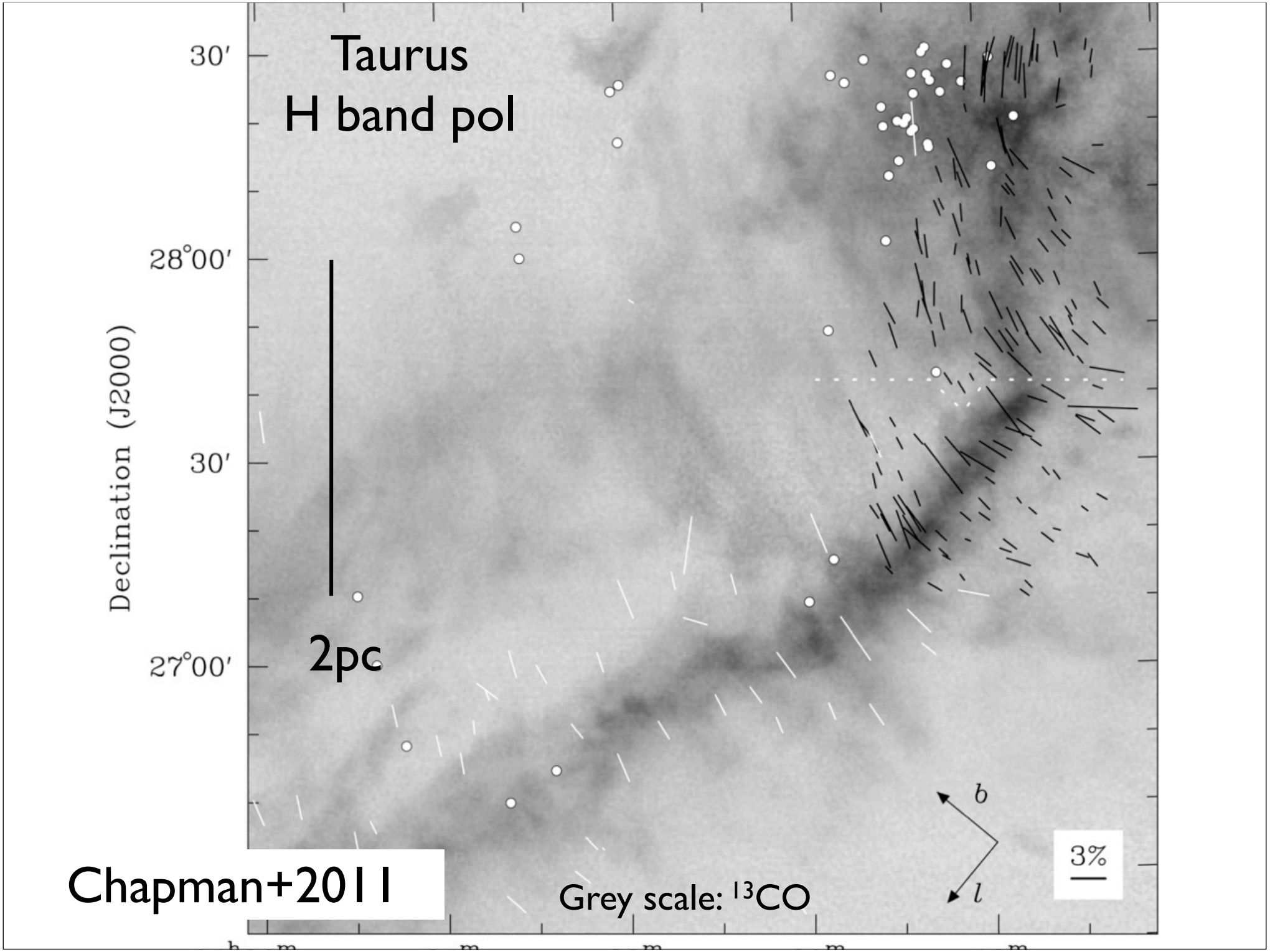
T ~ 10 (K)



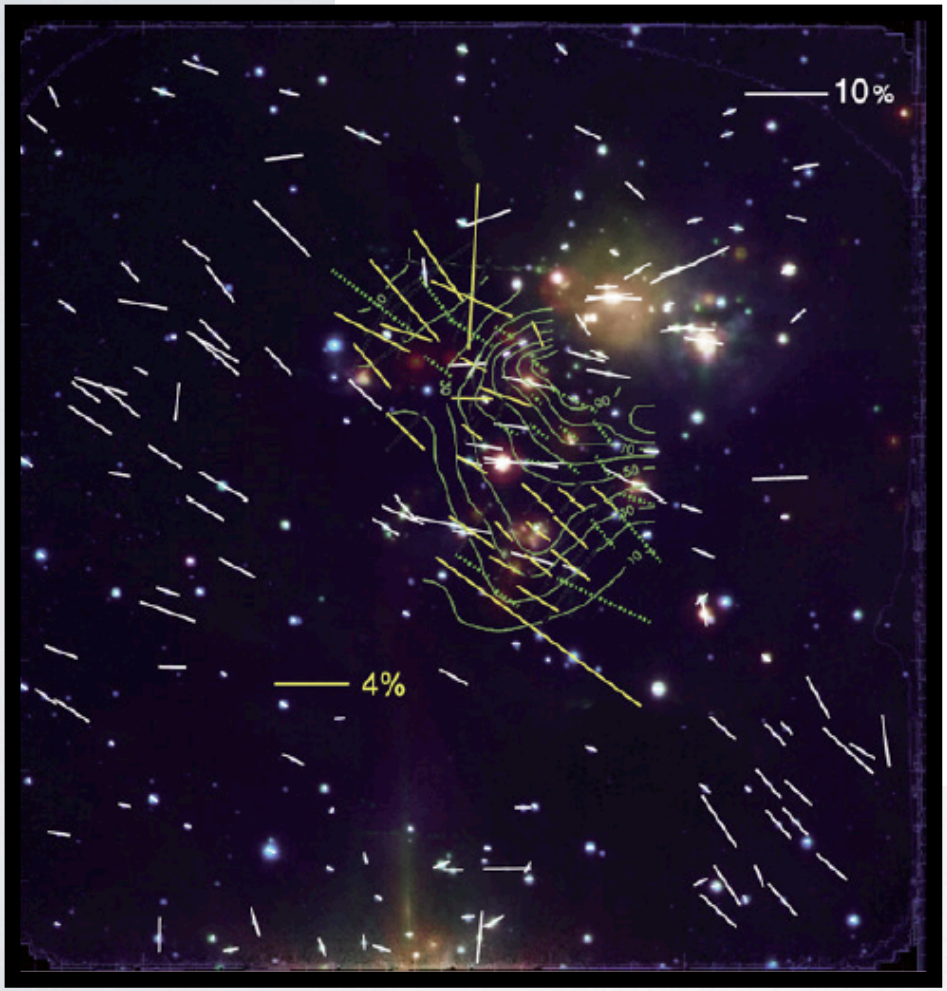

**paramagnetic, elongated, rotating…**

(e.g. Hildebrand 1988, Lazarian 2000…)

- in submm: linear polarization from thermal dust emission
- coherent alignment mechanism: B field is one possibility
- mechanism provides only projected field orientation/morphology
- need something more to derive field strength


Taurus
H band pol
2pc
Declination (J2000)
30′
28°00′
30′
27°00′
b
l
3%
Grey scale: $^{13}$CO
Chapman+2011

# NGC 2264

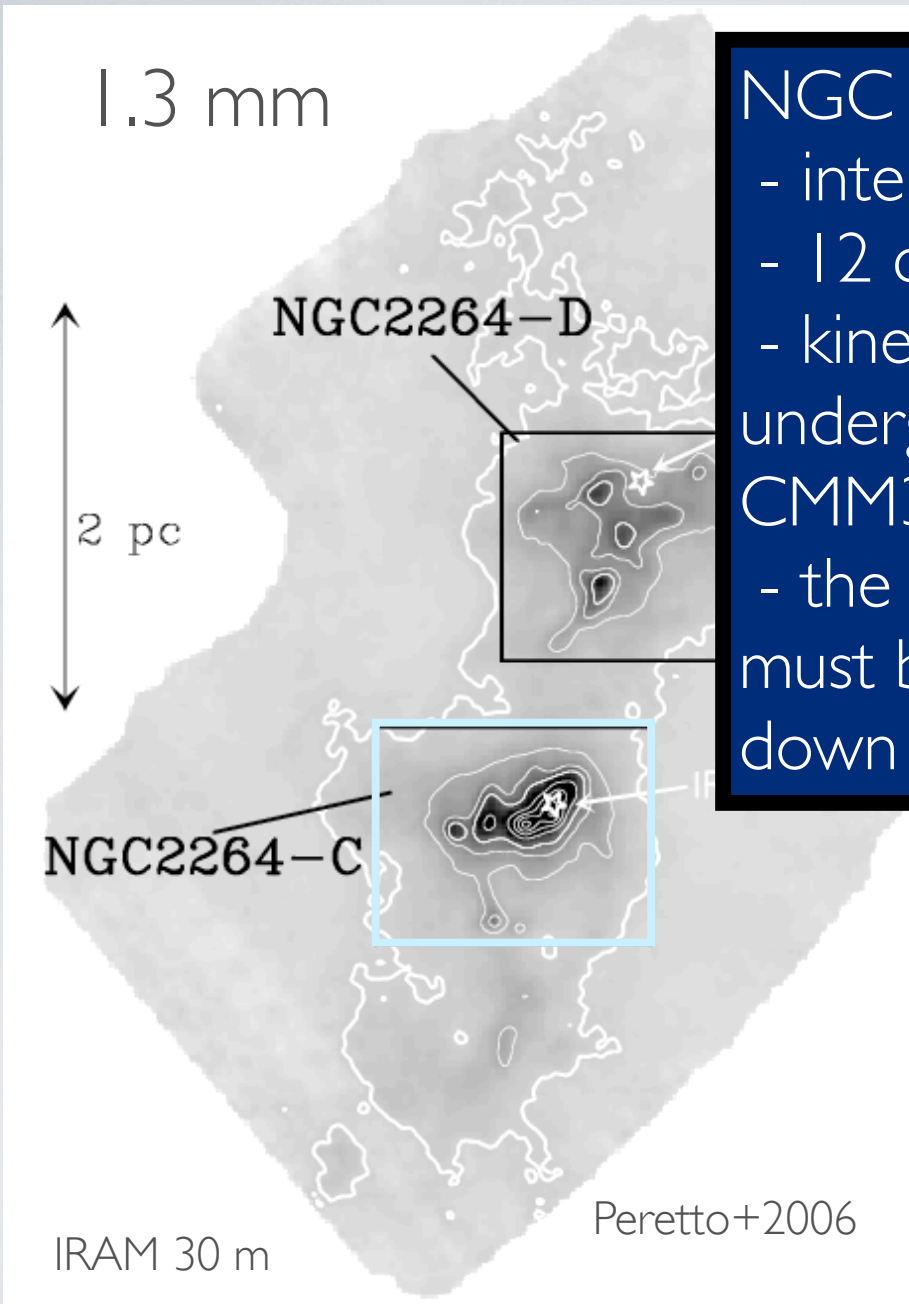



7 pc

Optical/Near Infrared polarization:

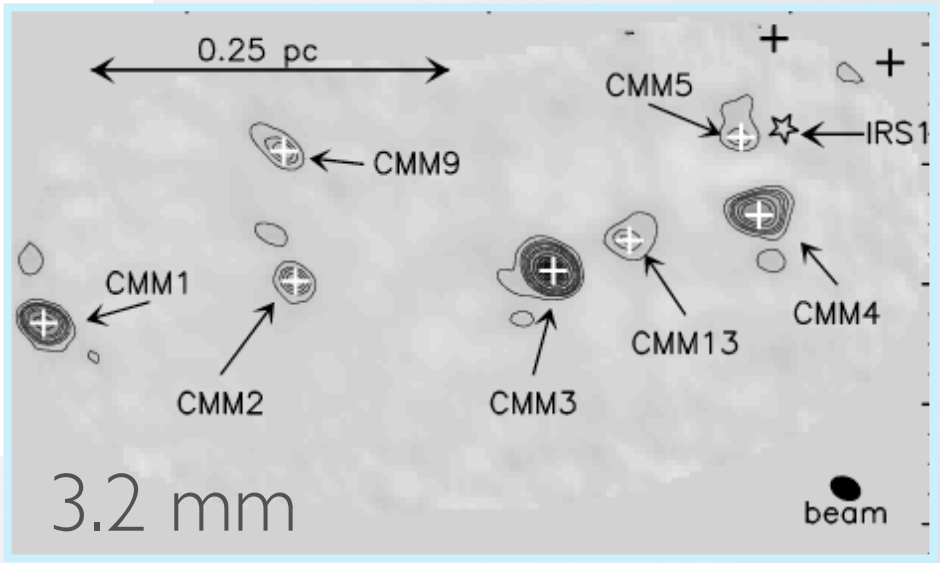
- the B field in cluster forming regions is almost perpendicular to the galactic B field

- How does the B field look like in the dense core forming scale?



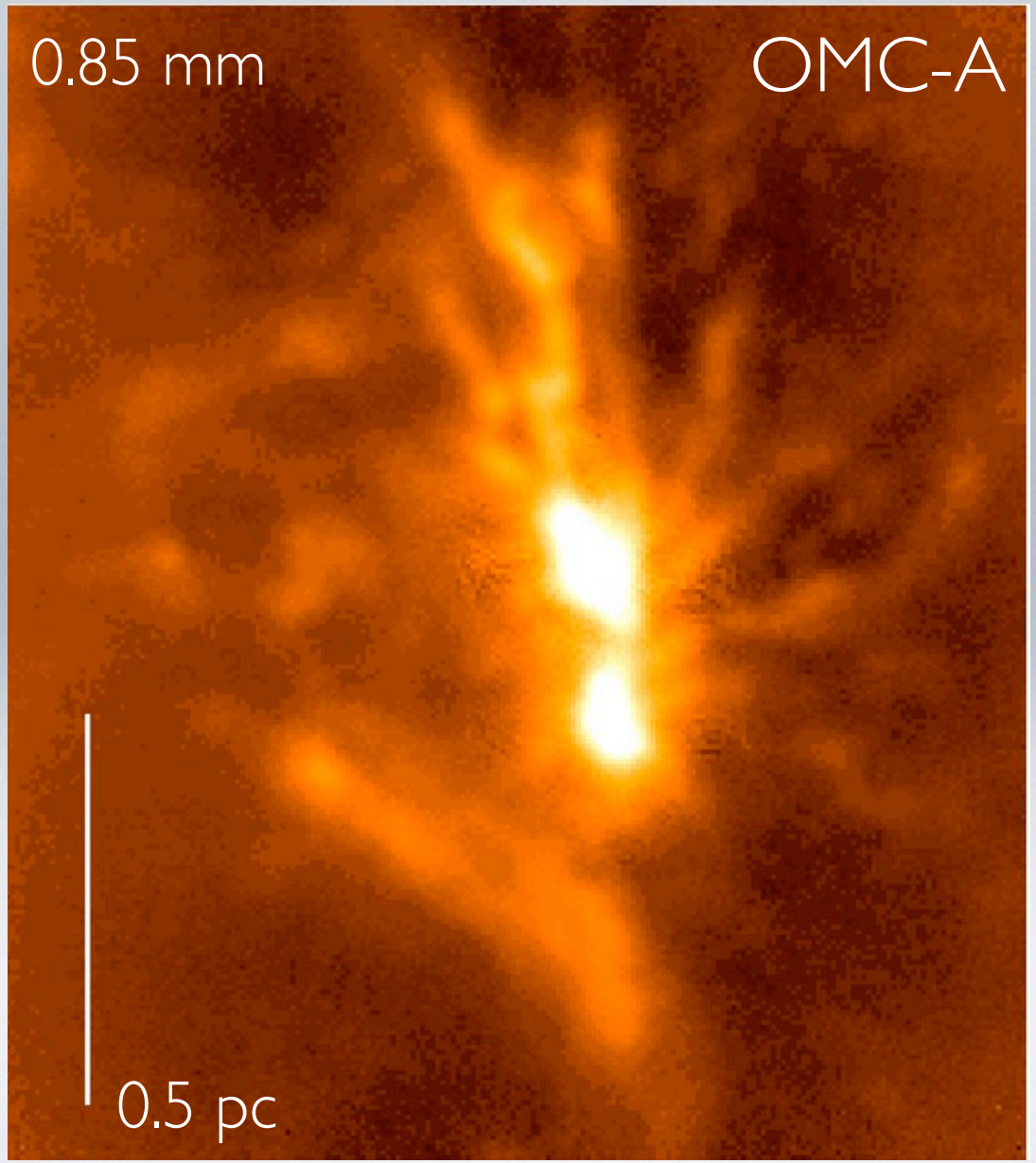

NGC 2264-C

- intermediate mass star forming region
- 12 class 0/1 sources
- kinematics suggests that the region is undergoing global collapsing toward CMM3
- the energetics suggests that the region must be supported by B field to slow down the SF rate

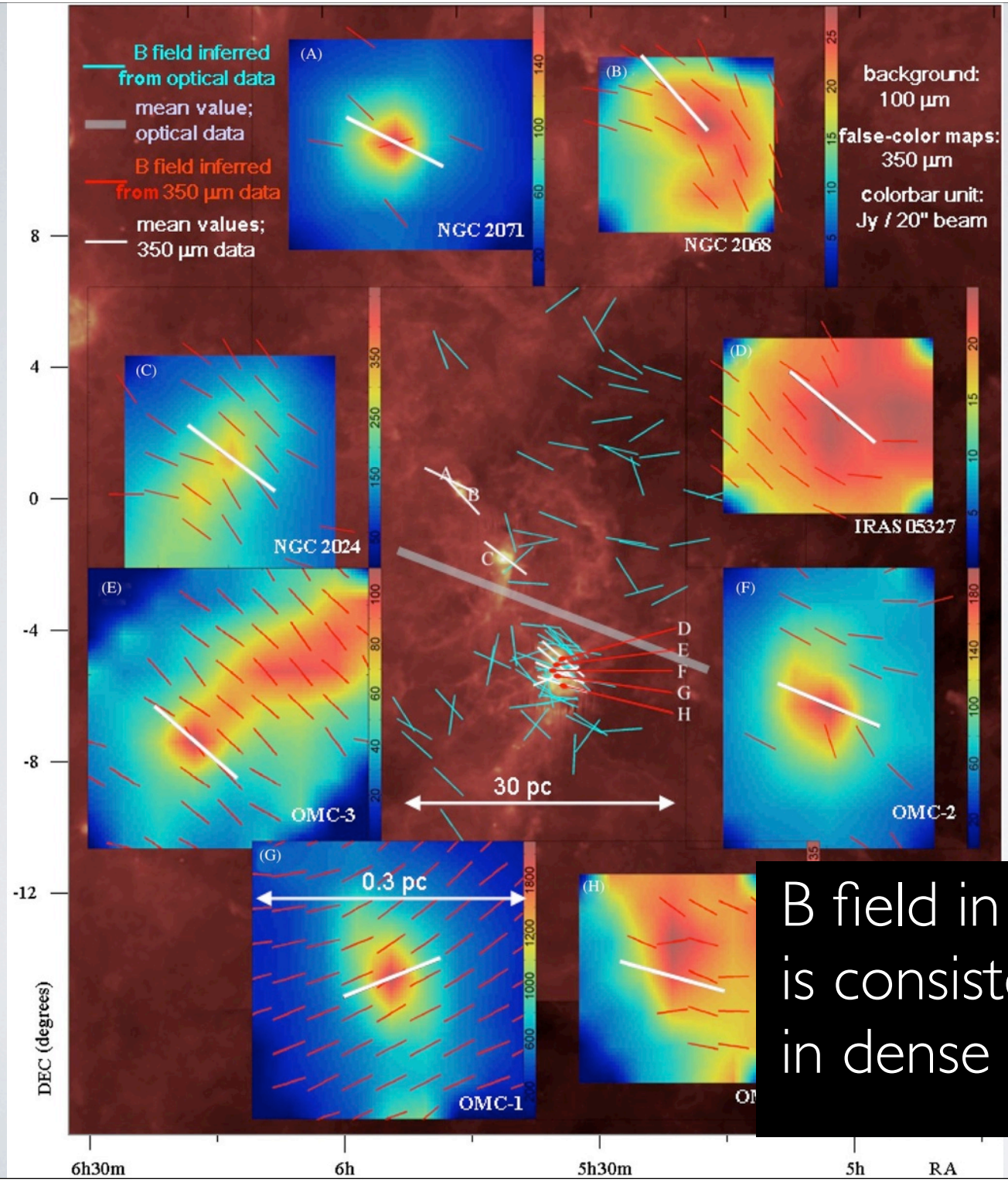



PdBI

Peretto+2007



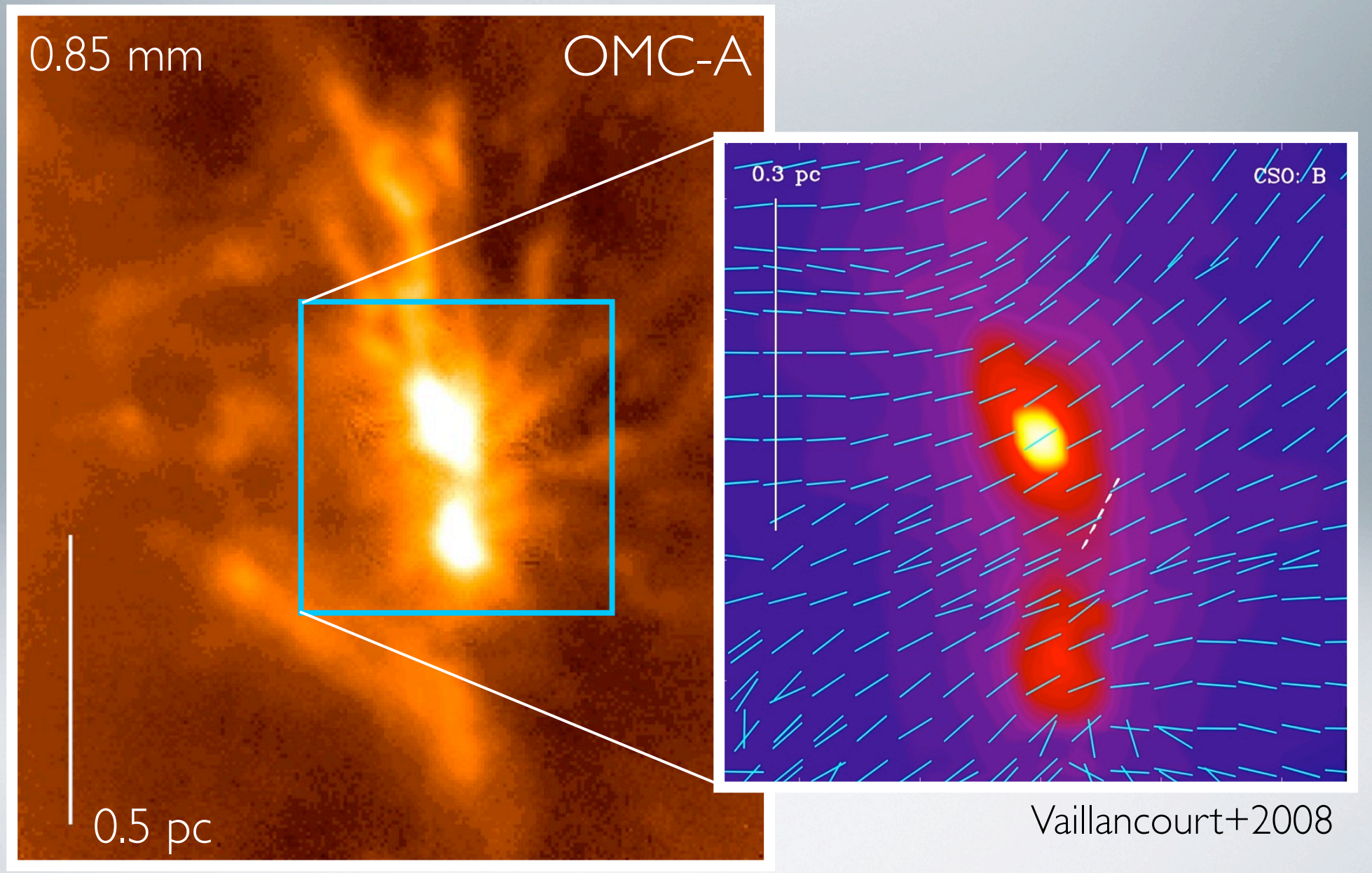

Johnstone+ 1998




B field in the dense clouds is consistent with the ones in dense cores

Li+2006

# II mm/sub-mm polarization

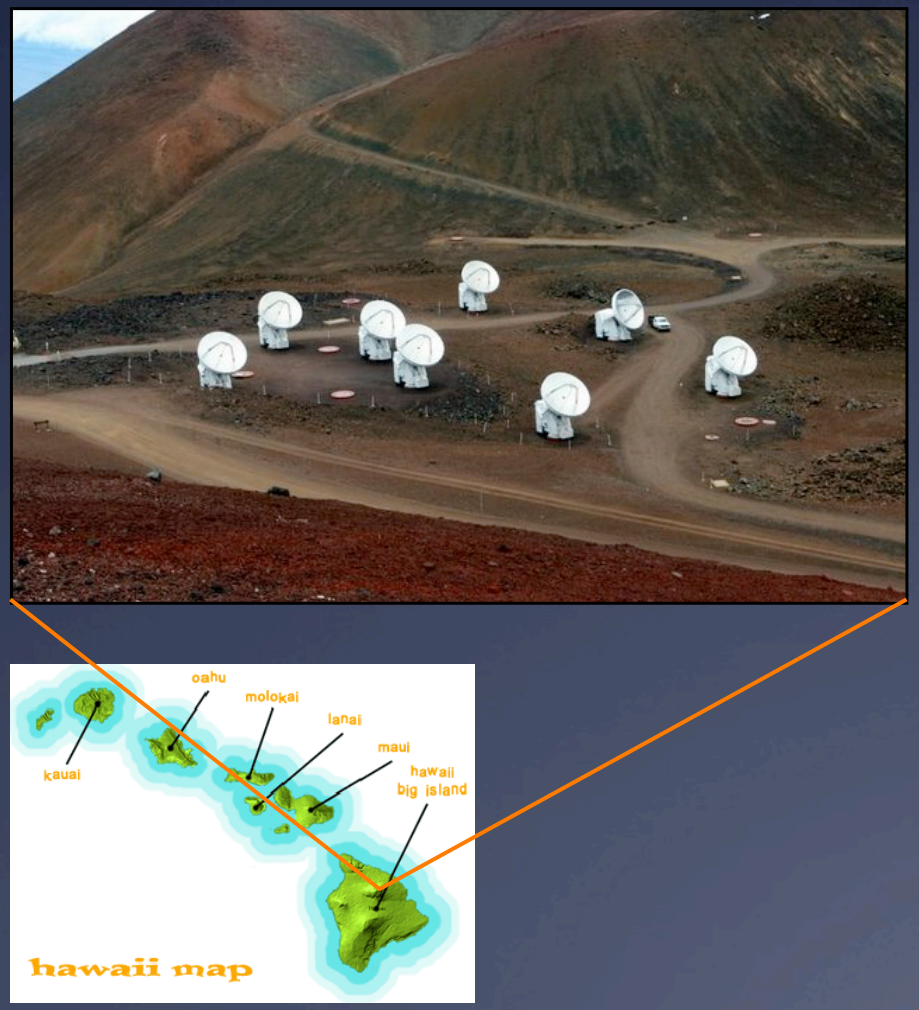



Johnstone+ 1998

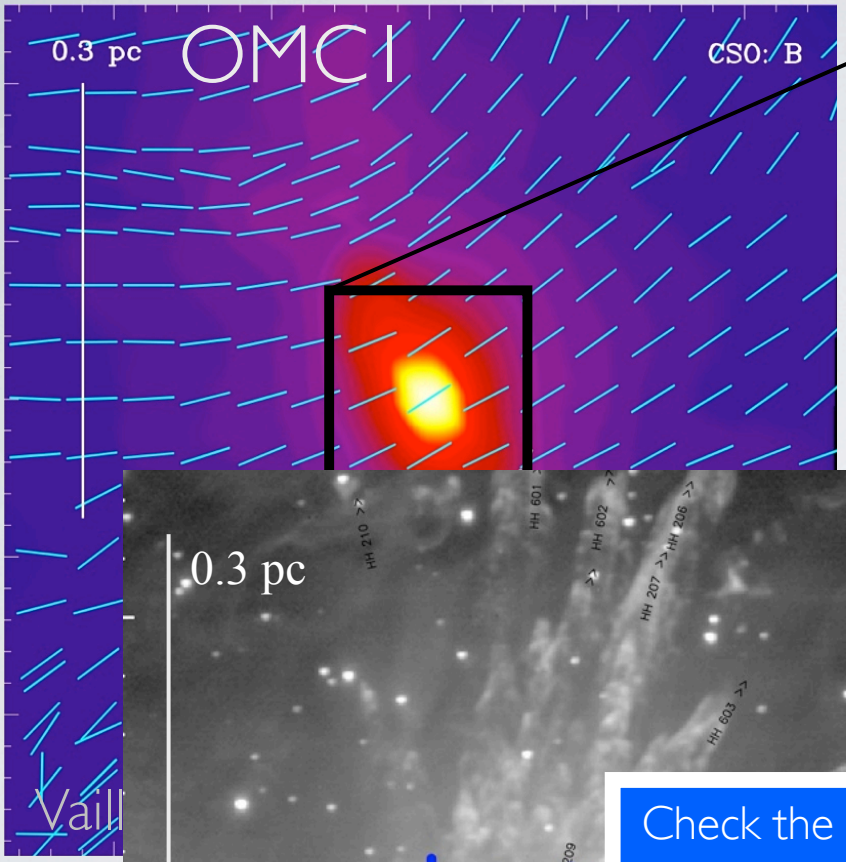
Vaillancourt+2008

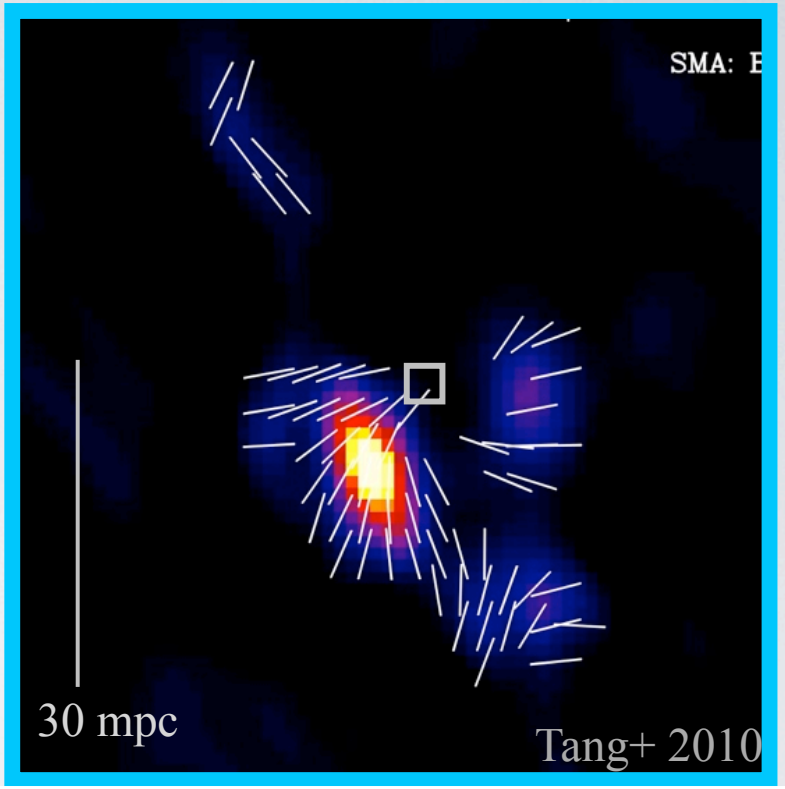
# Observations

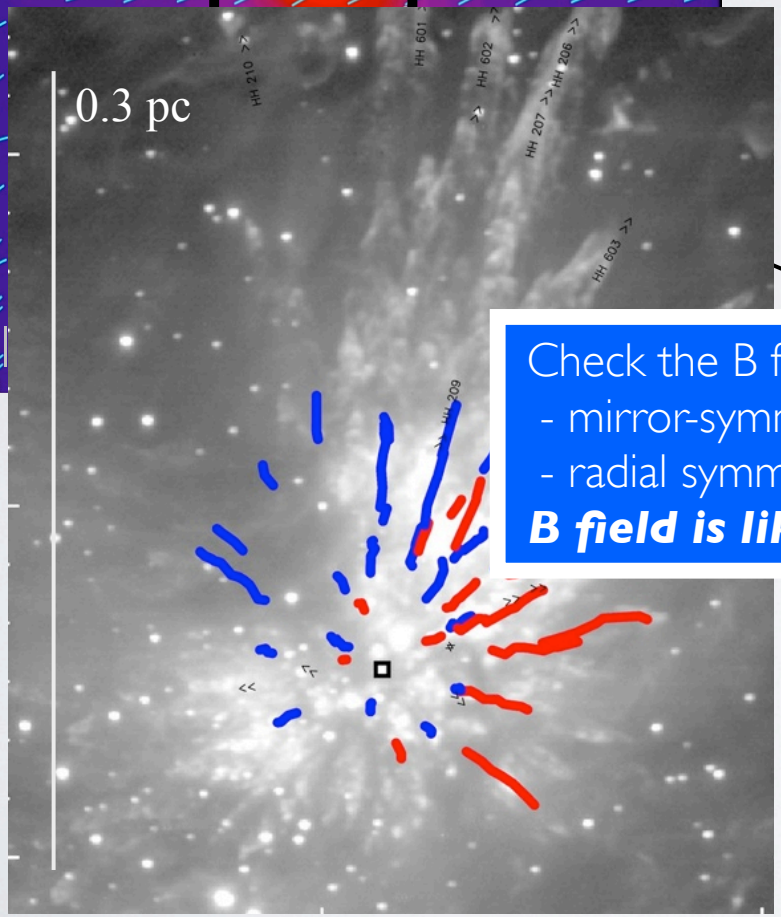
Sub-Millimeter Array (SMA)




- 8 x 6-m antennae
- Frequency: 345 GHz (870 μm)
  - ➔trace thermal dust emission
- Quarter-wave plates
  - ➔ measure dual polarization
  - ➔Stokes I, Q, U & V
- Angular resolution: ~1″

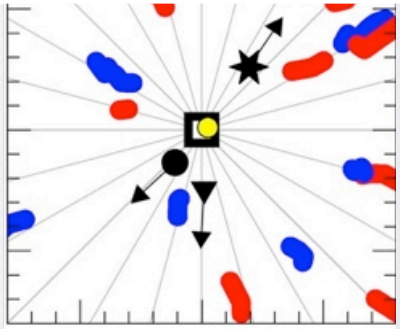


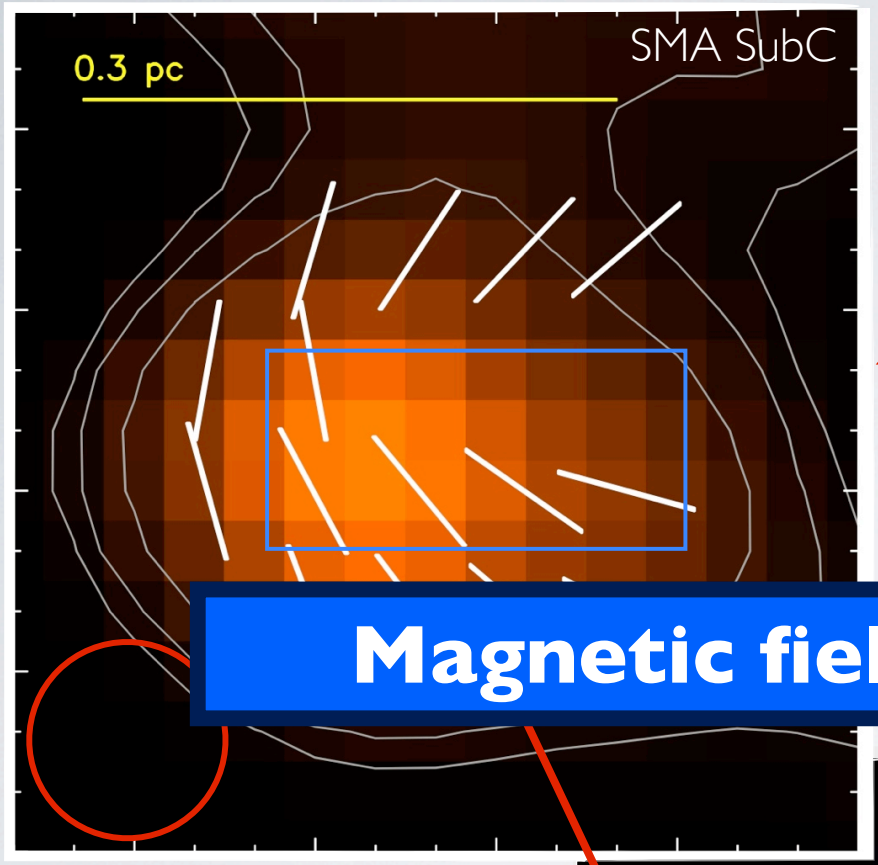

Check the B field symmetry
- mirror-symmetry along the 1 pc scale dust ridge
- radial symmetry with the center near the mm continuum deficit

***B field is likely shaped by stellar feedback***

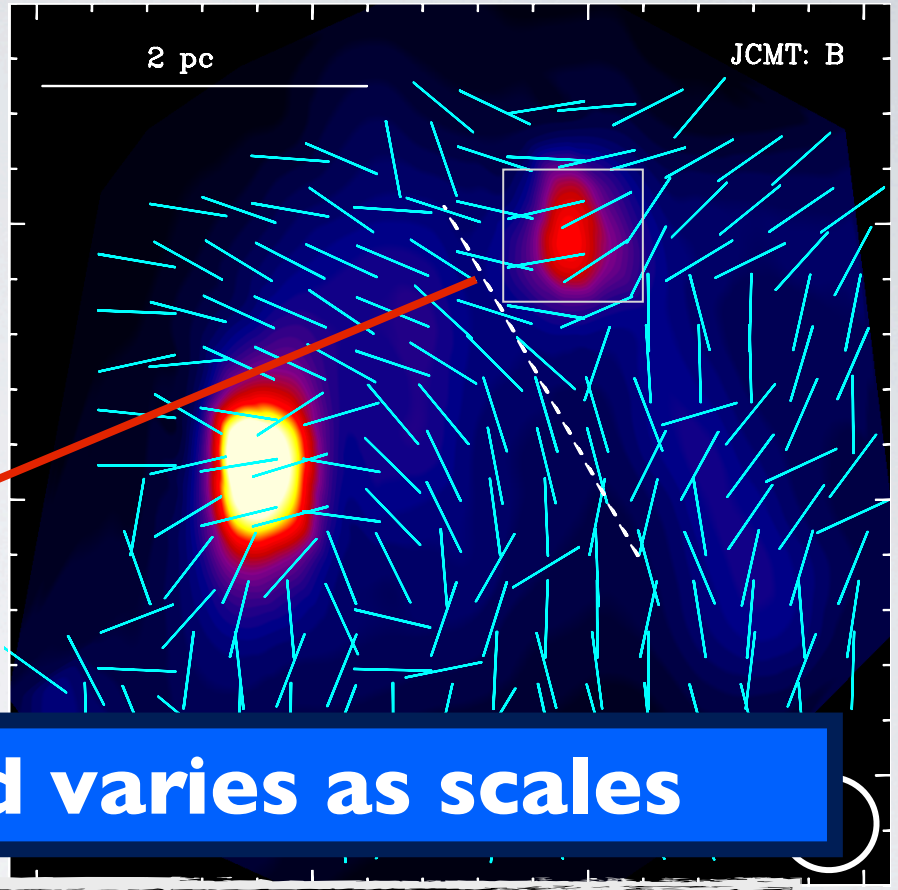


Color lines: CO outflow Zapata+2009
Background: $H_2$ jet

# W51 North:

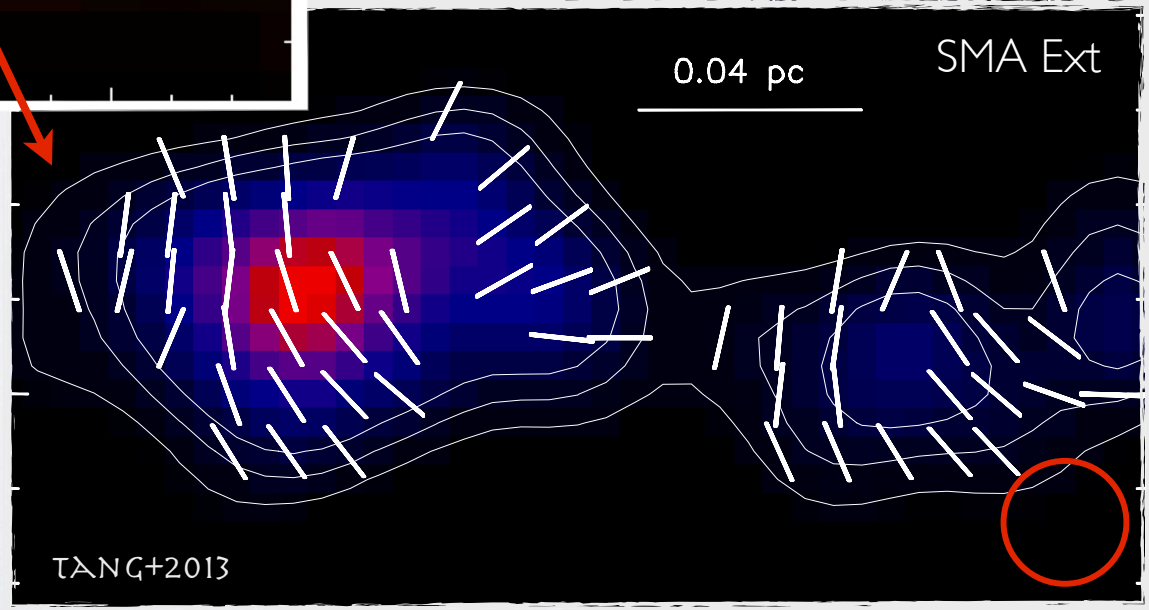



3.5”




15”

**Magnetic field varies as scales**




0.7”

# SUMMARY

- The sub-mm polarization can trace the B field in dense star forming cloud
  - In Orion BN/KL: the B field is likely shaped by stellar feedback while still remains some large scale B field
  - In W51 regions: B field varies as scale
  - N2264C for linking the B field between the cores and the cloud B field

Thank you