Fragmentation of massive dense cores down to ~1000 AU: *relation between fragmentation and density structure*

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Context: Numerical simulations show that the initial density profile of a massive dense core affects its fragmentation (the flatter the profile, the higher the fragmentation, e.g. Girichidis+11).

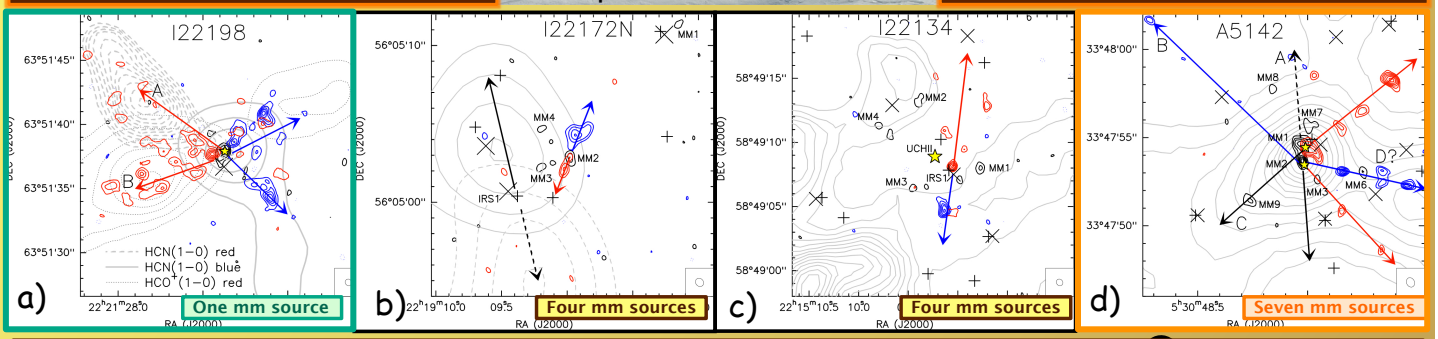
Aims: *studying fragmentation (~1000 AU) and density structure (~20000 AU) in a sample of ~20 massive dense cores*

1.3 mm + CO(2-1) OBSERVATIONS:
PdBI EXTENDED config.: 0.44" x 0.38"

Mass sensitivity ~0.3 M_o,
Spatial resolution ~1000 AU

Observations and Targets:
Observations with PdBI down to 0.4'' of 4 intermediate/high-mass star-forming regions:

IRAS 22198+6336:	760 pc	370 L_o
IRAS 22172+5549N:	2400 pc	830 L_o
IRAS 22134+5834:	2600 pc	11800 L_o
AFGL5142:	1800 pc	2200 L_o



All panels: **black contours:** 1.3 mm PdBI-A emission; **blue/red contours:** high-velocity CO(2-1) PdBI-A blueshifted/redshifted emission; **Grey contours:** a) HCN(1-0) and HCO+(1-0) PdBI-CD; b) CO(1-0) OVRO; c) and d) NH3(1,1) VLA. [Arrows: outflow directions; plus signs: 2MASS sources; crosses: Spitzer/IRAC1 sources].

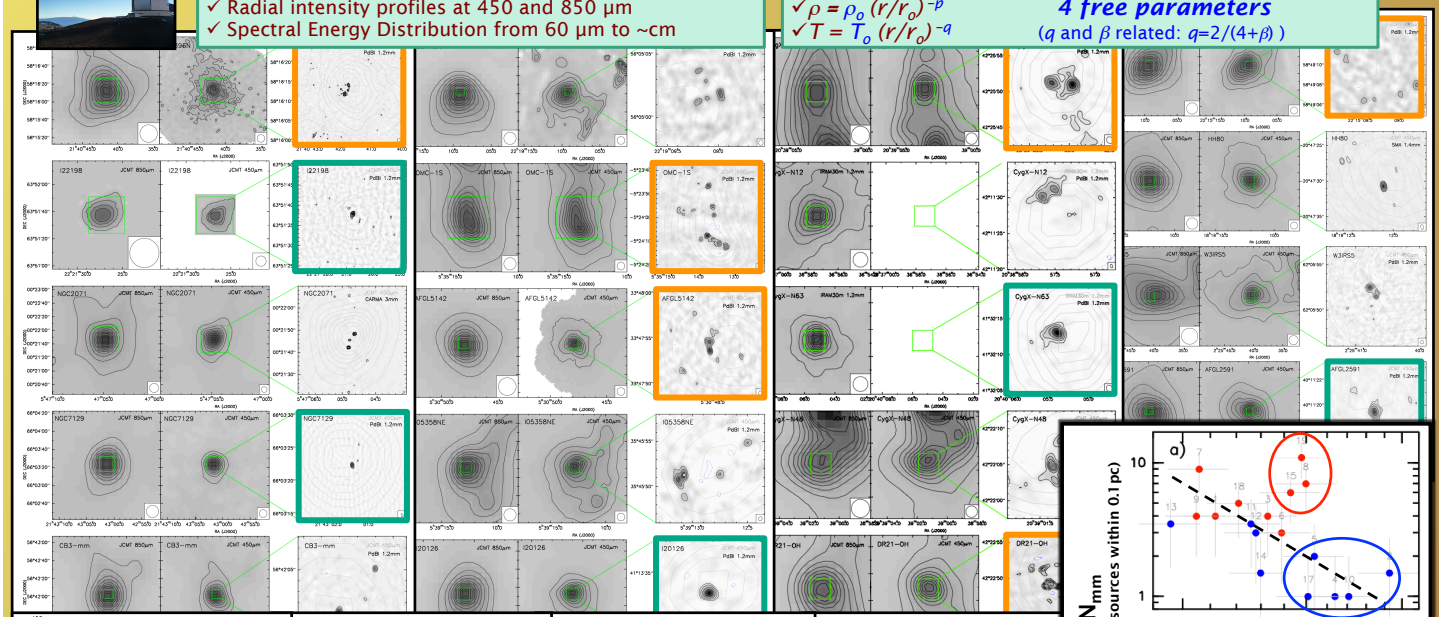
fragmentation level

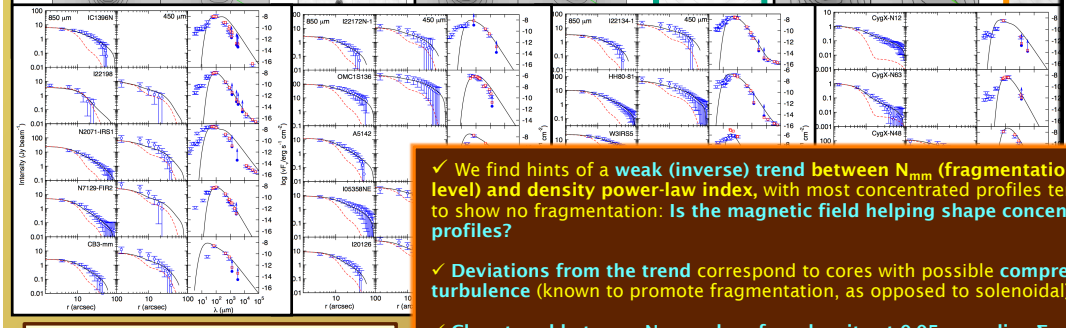
We complemented the 4 observed regions with other regions from the literature observed also in the mm down to ~0.5 M_o and ~1000 AU:
out of 19 cores, 30% do not fragment (turquoise square), 50% show >~ 4 fragments (orange square)

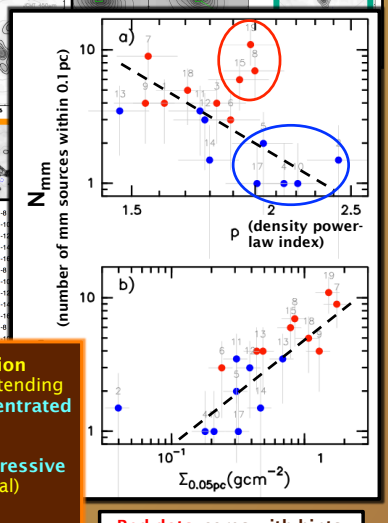
Density structure studied from JCMT submm continuum emission from SCUBA Legacy Catalog (Di Francesco+08):
- ✓ Radial intensity profiles at 450 and 850 μm
- ✓ Spectral Energy Distribution from 60 μm to ~cm

… modeled assuming: spherically symmetric cores with
- ✓ $\kappa_\nu \propto \nu^\beta$
- ✓ $\rho = \rho_o\,(r/r_o)^{-p}$
- ✓ $T = T_o\,(r/r_o)^{-q}$

4 free parameters
(q and β related: $q=2/(4+\beta)$)







✓ We find hints of a **weak (inverse) trend between N_{mm} (fragmentation level) and density power-law index,** with most concentrated profiles tending to show no fragmentation: **Is the magnetic field helping shape concentrated profiles?**

✓ **Deviations from the trend** correspond to cores with possible **compressive turbulence** (known to promote fragmentation, as opposed to solenoidal)

✓ **Clear trend between N_{mm} and surface density at 0.05 pc radius $\Sigma_{0.05pc}$:** cores with flat density profiles and high density ρ_o tend to fragment more

Red dots: cores with hints of compressive turbulence?

follow-up of: Palau et al. 2013, ApJ, 762, 120
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