Massive Quiescent Cores in Orion – The Core Mass Function

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CORE MASS FUNCTION

The Core Mass Function $CMF = N_{core}(M_{core})$

is central for a number of key questions in star formation theory

- What is the relationship between the CMF and the stellar IMF?
- Do individual cores collapse to form individual stars?
- What is the role of the environment?
- Where and when does fragmentation take place?

OBSERVING CLOUD CORES

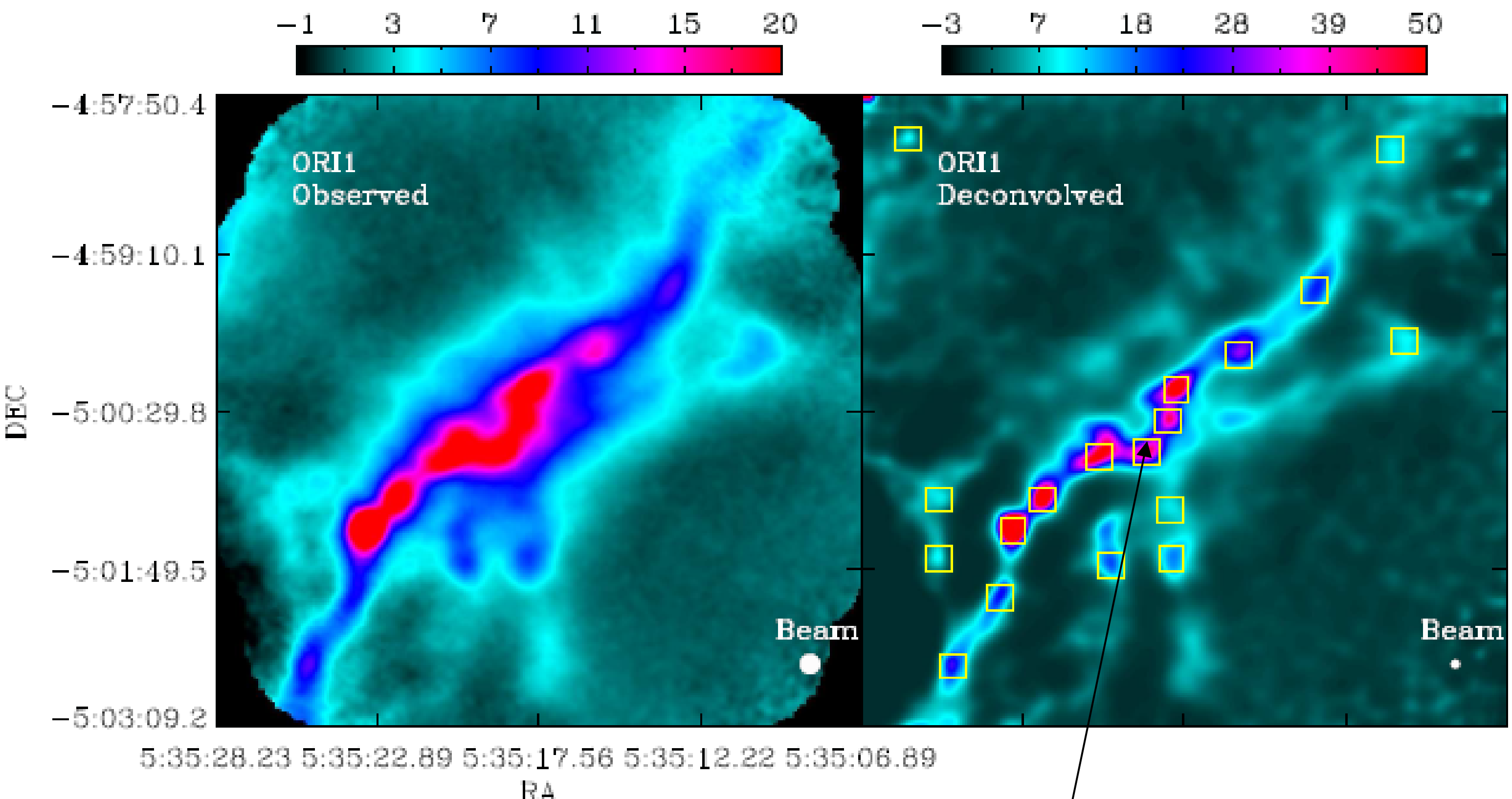
CMF studies to date have been largely restricted to low-mass star-forming regions

The present study focuses on a HIGH MASS star forming region, **ORION**, but observes positions sufficiently far from KL that effects of previously-formed massive stars are not overwhelming

Used the SHARC2 array on 10m diameter CSO telescope at 350 μm; $\Delta\theta = 9''$

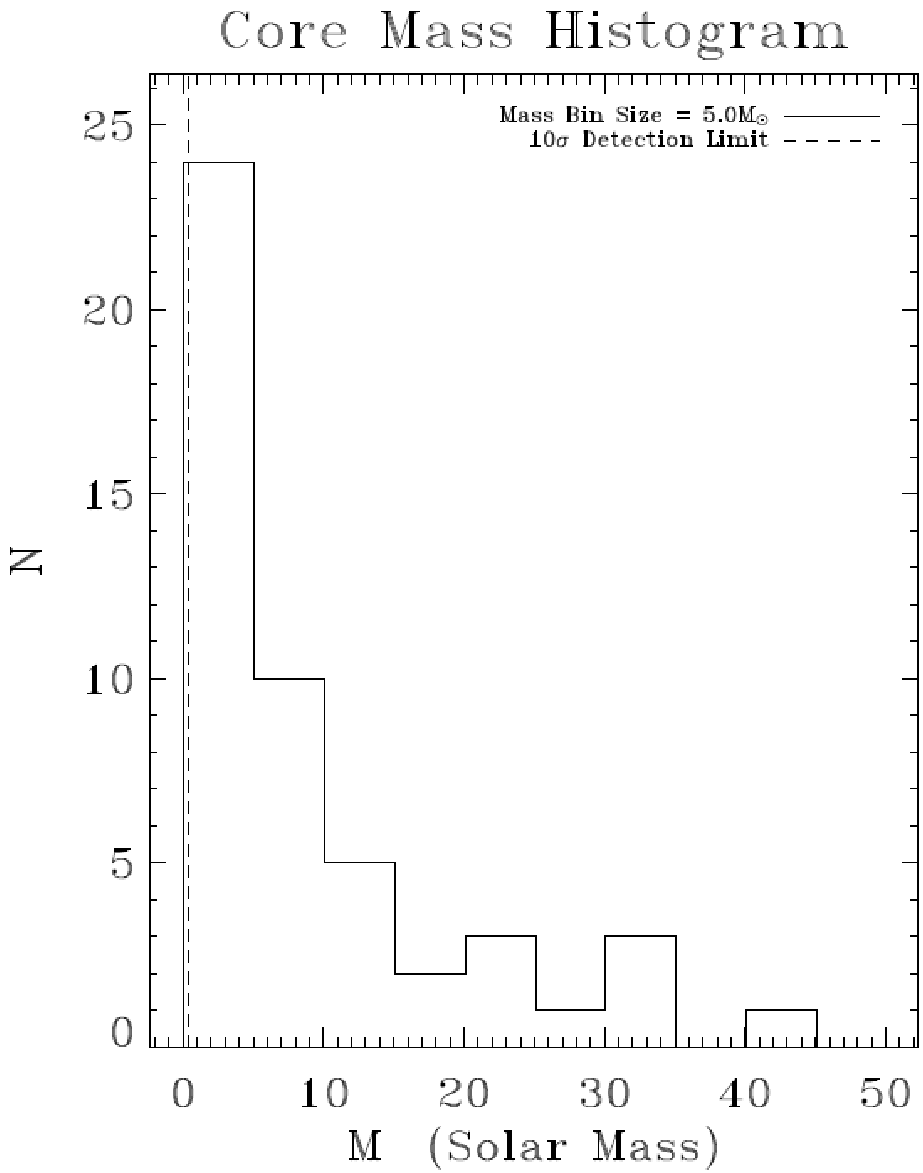
Angular resolution critical for determining core properties; use deconvolution to enhance resolution to $\Delta\theta \sim 3''$, corresponding to size = 0.007 pc at distance of Orion

CORES IN ORION1 REGION



Enhanced angular resolution ESSENTIAL to determine core size and mass

Cores identified with COREFIND algorithm



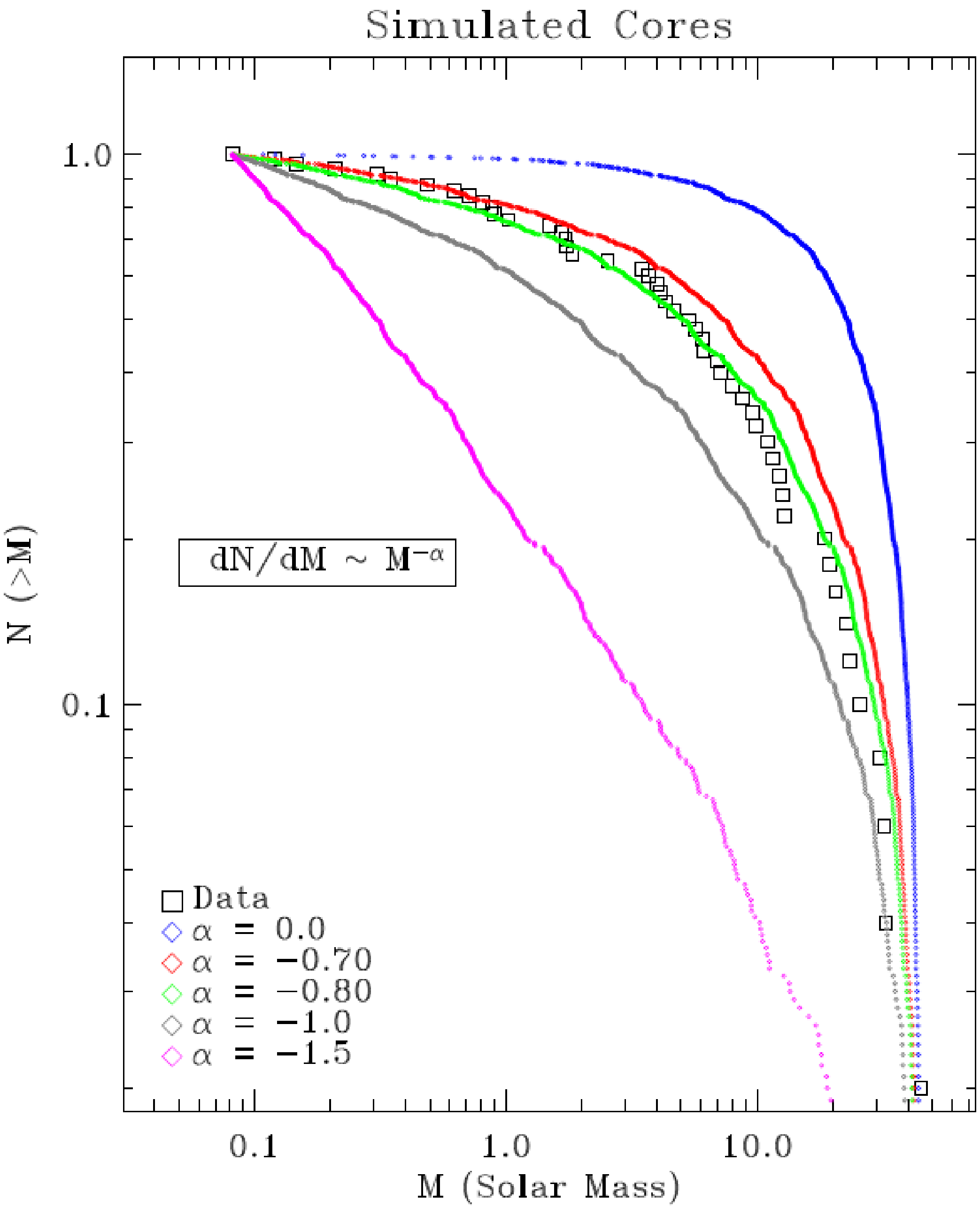
51 cores identified

Mass determined from standard dust properties and dust temperatures inferred from NH_3 measurements of gas temperature

Determining Core mass function is challenging

Limited sample size makes use of differential mass function N(M) difficult

Cumulative mass function N(>M) is an attractive approach, but serious errors can result from fitting power laws



Better technique – generate population of "simulated cores" and compare with observations

Simple approach – single power law distribution – results in good fit to CMF for **α = -0.80**

Previous studies have obtained similar-looking CMF and fit TWO power laws to different parts of curve

Single power law exponent very different from stellar IMF => core evolution **is** important. Fragmentation, but what else may go on?

SUMMARY and IMPLICATIONS

- High sensitivity, high angular resolution study with the CSO indicates that pre-stellar cores in outlying portions of ORION high mass star forming region have masses between 0.1 M_{solar} and 50 M_{solar}
- The core mass function is described by a single power law: $N(M) \sim M^{-0.8}$, very different from stellar IMF
- This type of study requires best possible resolution, and LARGE CORE SAMPLES to determine the effect of environment and the evolutionary steps between cores and stars
- CCAT will be the exemplary facility for this type of study, offering improved angular resolution, larger arrays and coverage, and multiple wavelengths to fit dust temperature distribution directly