The Spatial Relationship Between Forming Stars and Their Dense Cores

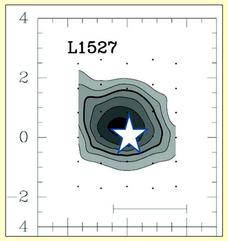
Jared Keown – University of Louisville **Ned Ladd** – Bucknell University

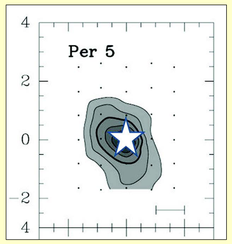
Goal

To investigate the spatial relationship between forming stars and dense interstellar gas as a function of stellar age.

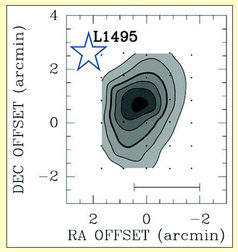
Introduction

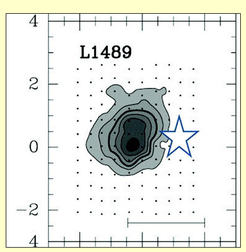
Since dense gas cores serve as the material from which stars are formed, it's not surprising that we find forming stars in the middle of dense cores.





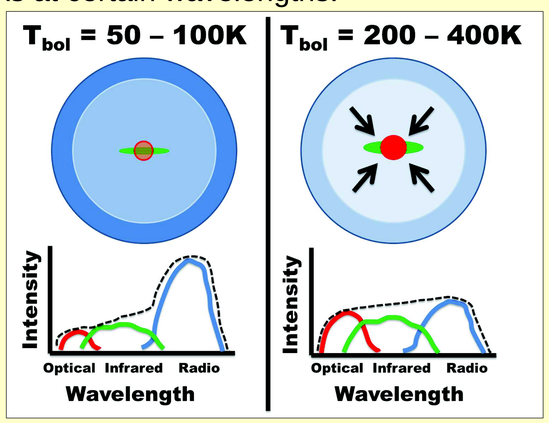
However, quite unexpectedly, we also find forming stars with significant separation from dense cores.



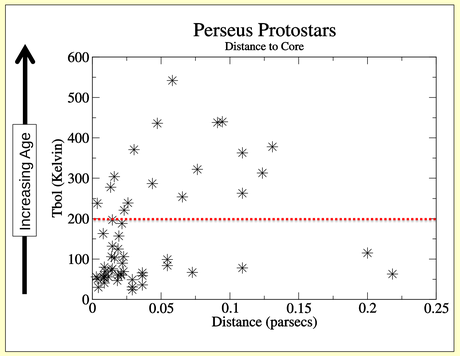


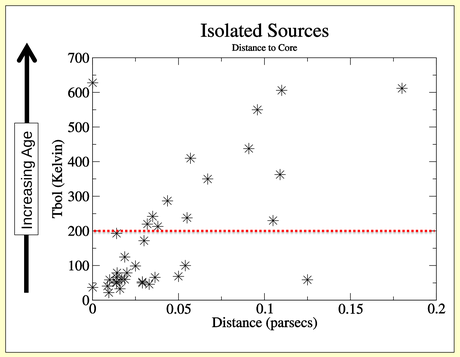
Star Age

Bolometric Temperature (T_{bol}) is used to determine a star's age using the star's spectral energy distribution (SED). SEDs from stars of certain ages have distinct peaks at certain wavelengths.



Results

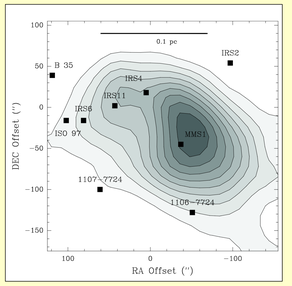




These plots show that younger stars are found close to the centers of dense cores, while older stars are found farther away. This general trend appears to hold true in both clustered and isolated environments.

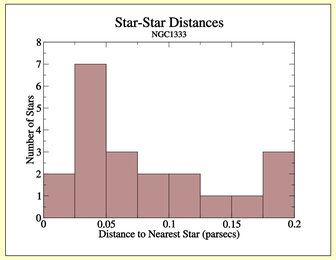
Stars were paired with their nearest dense core. Cores were identified using the density sensitive tracer molecules N2H+ and NH3.
Right: **Green Bank Telescope**
Credit: NRAO

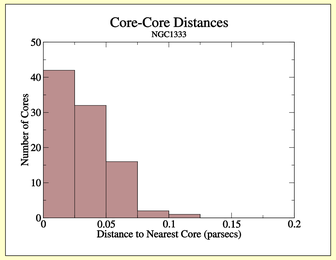
Perseus Molecular Cloud
Clustered Environment
Credit: Maximo Ruiz

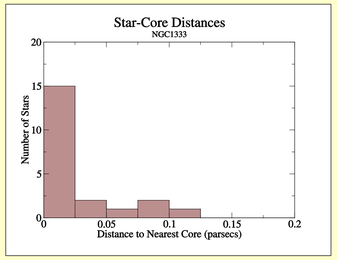


Cederblad 110 Region Contour Map
Isolated Environment

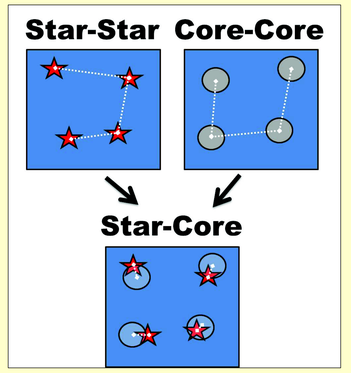
Analyzing Star-Core Associations







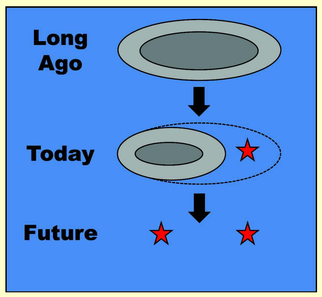
In crowded star formation regions, such as NGC1333, it's not obvious that forming stars are associated with the most nearby core. However, these results suggest that forming stars are "unusually" close to dense cores. Therefore, it appears more likely that a star and its forming core are indeed related.

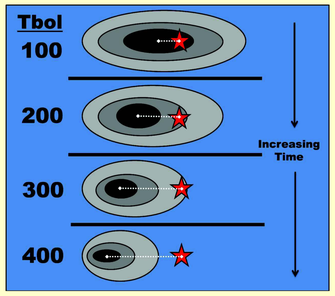


Pairing stars with stars and cores with cores results in larger distances than pairing stars with cores.

Implications

When we see stars far from cores, it may be that they've already "used up" part of a core that was once much larger. It's possible that we see a migration trend due to stars altering the contour of a dense core over time as they use the core's material to form.





Future Work

- Expand our database to include other molecular clouds in different regions of space.
- Write a proposal for observation time with a radio telescope to map interesting sources

Acknowledgments

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