Encounters of massive stars in the ONC?

C. Olczak*, S. Pfalzner

I. Physikalisches Institut – Universiät zu Köln, Zülpicher Str. 77, 50937 Cologne (Germany)

Introduction

Most young stars are observed to be surrounded by circumstellar matter in form of discs.
Discs around massive stars are generally not observed.

Massive stars do not form in isolation but are located in the center of dense star clusters.
The evolution of discs of high-mass stars is affected by other cluster stars.

Evolutionary effects on discs:
▶ Internal: internal photoevaporation, dust growth, ...
▶ External: external photoevaporation (by massive stars), stellar encounters, ...

Focus: encounters in young dense clusters.
Model cluster: Orion Nebula Cluster (ONC).

Question: **Is there observational evidence of stellar encounters of massive stars in the ONC?**

Mosaic image of the Orion Nebula from the Hubble Space Telescope's Advanced Camera for Surveys and the European Southern Observatory's La Silla 2.2 meter telescope (NASA,ESA, M. Robberto and the Hubble Space Telescope Orion Treasury Project Team, 2006).
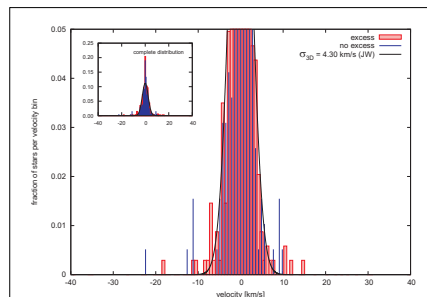
Observational data
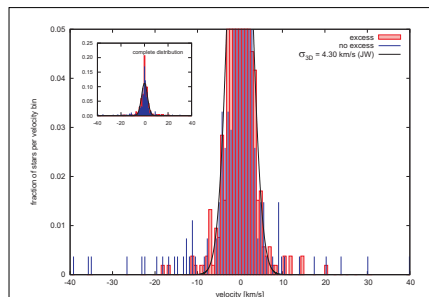
Distribution of proper motions of ONC stars (data compiled from [1, 2, 3]).

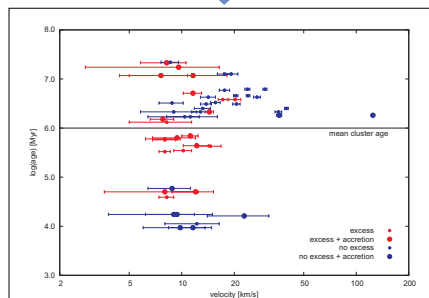Stars with and without IR-excess are shown.

Candidates for encounters: stars with high velocities (v > 3σ), most lack disc emission.

Distribution of proper motions (as first figure) restricted to stellar ages of 1 Myr.

Candidates for encounters are found at flanks.

Stellar encounters leave signature in velocity distribution? Even destruction of discs?

Simulations

Velocity distribution at 1 Myr from numerical simulations of the ONC with NBODY6++ [4, 5, 6].

Disc-less stars: disc-mass loss due to encounters.

Velocity distributions from observations and simulations show common features.

Discussion

Observational data of the ONC reveal a small sample of young, low-mass, high-velocity stars:

Potential stars for encounters close to the cluster center, probably with a high-mass object.

Simulations support the scenario of effective encounters between low- and high-mass stars:

Encounters between low- and high-mass stars occur early on in the cluster evolution.

Massive stars suffer a large number of encounters, leading to substantial disc-mass loss.

Age distribution of high-velocity stars (v > 3σ), features of IR-excess and accretion are indicated.

Bimodality: cluster members + foreground stars.

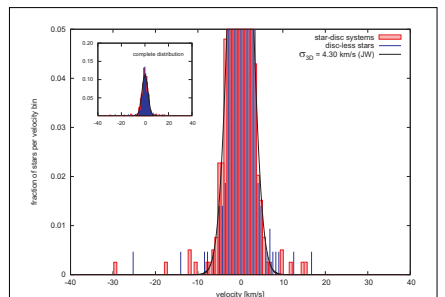**Restrict sample of high-velocity stars to stellar ages of 1 Myr (≈mean age of the ONC).**
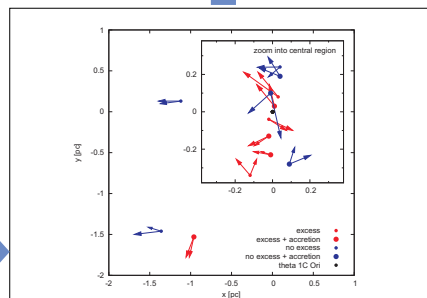
Positions and velocities of the age-restricted sample of high-velocity stars.

Most stars are concentrated in the cluster center.

Proximity to cluster center and high velocities indicate recent encounter (with massive star?).

References

[1] Hillenbrand, L. A. 1997, AJ, 113, 1733.
[2] Hillenbrand, L. A., Strom, S. E., Calvet, N., et al. 1998, AJ, 116, 1816.
[3] Jones, B. F. & Walker, M. F. 1988, AJ, 95, 1755.
[4] Olczak, C., Pfalzner, S., & Spurzem, R. 2006, ApJ, 642, 1140.
[5] Pfalzner, S., Olczak, C., & Eckart, A. 2006, A&A, 454, 811.
[6] Spurzem, R., Baumgardt, H. 2002, MNRAS, submitted.

*For further information, please contact olczak@ph1.uni-koeln.de