FORMATION OF BOUND AND UNBOUND STELLAR GROUPS FROM MOLECULAR CLOUDS

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Observations of the Lambda Orionis OB-T association indicate a very low efficiency of star formation: only about 0.5% of the total available molecular gas was processed into stars before the gas was removed from the association by the H II region and stellar wind generated by the OB stars at its center. These observations suggest an explanation for the unbound dynamical states of most OB associations. Most associations are formed in initially bound giant molecular clouds with low efficiency (i.e., 0.1 - 10%). Massive members of the association disrupt and dissipate the molecular gas via action of H II regions, stellar winds and supernova on a relatively short time scale (i.e., 10^6 - 10^7 years), leaving behind the recently formed stars. Since more than 90% of the original binding mass of the system is removed, the stellar association becomes unbound and expands. Expansion velocities of order a few kilometers per second are expected in such a scenario.

The existence of bound open clusters in the galaxy, on the other hand, suggests that occasionally star formation in a molecular cloud proceeds with very high efficiency with more than 50% of the total available gas being processed into stars before cloud disruption. Recent millimeter wave and infrared observations of the Ophiuchi Dark Cloud suggest that star formation in that cloud has already reached an efficiency of about 50%. How is it that some molecular clouds can produce stars with such high efficiencies? Millimeter-wave and infrared observations of Ophiuchi and detailed N-body dynamical calculations of early cluster evolution are combined to place constraints on this problem and the results are discussed in the presentation.

DISCUSSION

S. Strom: Is Taurus really a giant molecular cloud? Will it ever form massive stars?

Lada: It is a giant molecular cloud in the sense that it has 10^4 solar masses of molecular gas. I have no *a priori* reason to believe Taurus will form massive stars.

Carrasco: What you be your guess about the physics controlling the efficiency of star formation?

Lada: A cloud like the one associated with Rho Ophiuchi has very narrow lines and no evidence of energetic mass outflows, as opposed to other more active clouds. Maybe this allows star formation to proceed for longer periods of time.