HASEGAWA: What is the range of the intensity ratio between the v = 2-1 and v = 1-0 S(1) lines in your model? Is it possible to tell whether H_2 is excited by a shock or by UV radiation based on that ratio?
VAN DISHOEK: The ratio is 0.57 in the fluorescent model of the reflection nebula NGC 2023. This value is quite insensitive to the conditions in the cloud. If the H_2 molecules were excited by collision in a shock at a temperature of 2000 K, the ratio would be much lower, about 0.1.

INDUCED STAR FORMATION IN M17: HIGH RESOLUTION NH_3 AND IR OBSERVATIONS

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A VLA radio continuum study of the H II region M17 (Felli, Churchwell and Massi, 1984) has shown the presence of an elongated sharp arc structure in the South Bar of the nebula, in a region of heavy obscuration. The arc has been interpreted as an ionization boundary, viewed edge on, located between the diffuse H II region, to the east, and a dense component of the extended molecular cloud, to the west. About 3" to the west of this arc, an ultra-compact H II region has been found. This has a shell type structure, a linear diameter of 0.004 pc and probably is the result of induced star formation in the molecular cloud produced by the pressure front preceding the ionization front.

In this paper, we present preliminary results of VLA observations of the (1,1) NH_3 line emission from the molecular component facing the ionization front and 3.6 m ESO mapping of the same region at 10 and 17.4 μm, aimed to resolve the emission of the ultra-compact component from that of the ionization front.

The NH_3 emission (spatial resolution 5", velocity resolution 1.2 km s^{-1}) comes primarily from a 60"×30" region about 30" to the west of the arc structure and is bounded on the east side by the ionization front. Isolated NH_3 blobs are also present to the east of the arc. The NH_3 emission is highly clumped and shows distinct velocity components. In particular, near the peak of emission there are two velocity components separated by 2 km s^{-1} and spatially adjacent. The main line optical depths are rather high (≅ 2) indicating large densities for the components. These molecular blobs represent sub-condensations in the molecular cloud which will, eventually, be triggered to collapse by the shock front preceding the ionization front. No NH_3 feature is directly associated to the ultra-compact H II region, or to the IR sources.

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Two IR maps (with a resolution of 3.2") and three slit scans through the source (with a resolution of 1.6"×10") taken at 4.7, 10 and 17.4 μm, are capable to clearly resolve the emission of the arc from that of the ultra-compact H II region. Comparison between the different bands indicates that at 10 μm the ultra-compact H II region emits about 40% of the total flux, while at 17.4 μm the percentage is only 15%. This implies that the dust associated with the ionization front is cooler than that of the ultra-compact H II region.

Heating of the dust in the ionization front can be supplied by the early type stars of the OB cluster in M17 (to the east of the arc) while heating of the dust in the ultra-compact H II region must come from the early type star (a B0-B0.5 ZAMS, as implied from the radio flux) assumed to be located inside the cocoon and responsible for its ionization.

REFERENCE

Felli, M., Churchwell, E., and Massi, M.: 1984, Astron. Astrophys. 136, 53.

PANAGIA: Can you give an estimate of the luminosity of the compact source and, therefore, of how massive is the star we are dealing with?

FELLI: The luminosity of the compact source estimated from the IR data is $\cong 3\times10^3$ $L_\odot$. This, together with $N_L = 2\times10^{47}$ photons s^{-1} derived from the radio flux indicate that a B0-B0.5 star must be embedded within the compact H II region.

KRUGEL: Another argument in favor of induced star formation in M17 comes from stars at the interface between the H II region and the molecular cloud found by Chini and me. They have the highest 10 and 20 μm excess known for optically visible stars. Analysis of their IR spectra showed that they possess thin dust cocoons. In their evolution they are therefore intermediate between the evolved stars in the H II region and possible protostars in the molecular cloud.

DOPITA: Can you exclude the possibility that your ultra-compact H II region is ram pressure confined by an accretion flow, and hence may be older than the figure you give.

FELLI: The figure given (10^2-10^3 years) is a very rough back of the envelope estimate. There are no observations of comparable resolution that could bear on your question.