OBSERVATIONAL DATA ON STAR FORMATION IN CEPHEUS A

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Cep A is a condensation in the larger CO cloud originally mapped by Sargent (1977,1979), and contains radio H II regions, OH and H_2O masers, a far infrared luminosity of 2.5×10^4 $L_\odot$, anisotropic mass outflow as seen originally in CO but later in other molecular lines, and a Herbig-Haro object.

High resolution radio observations using the VLA at λ 20-cm and λ 6-cm (Hughes and Wouterloot, 1984) show that the radio emission originates from about 14 individual H II regions, each of which could be produced by a B3 star, the total luminosity of these stars equals the total infrared luminosity. The resolution of 1" at the distance to Cep A of 725 pc corresponds to linear diameters < 1000 au for the components, and suggested that their age could not be greater than $\sim$1000 years.

More recent observations with angular resolution at 0".3 show that though some regions are resolved, others are not, and indicate diameters $\sim$ 200 au. When the spectral indices of the individual components are measured, it is found that the diffuse components have $\alpha \sim -0.1$, as would be expected for optically thin H II regions. However, the more compact regions have $\alpha > -0.1$, indicating that part of the region is optically thick. One region in particular has $\alpha = 0.6$, but when use is made of other observations at λ 2-cm, and λ 0.3-cm, it is found that α is even higher, approaching that of a black body. Assuming spherical symmetry, the spectrum is fitted to a model with an inverse square law variation of electron density with radius, but at a radius $\sim$ 2.1 au the density increases to $\sim10^9$ cm^{-3} and the temperature to 2×10^4 K. The ionization could be produced by a B3 star without atmospheric blanketing, and it is believed that this source corresponds to the stage where the star ceases to accrete from the interstellar medium and the radiation pressure is initiating an outflow. The other more diffuse regions are the later stages where the H II regions are developed and are expanding.

Further confirmation of the model for the region comes from the fact that the H_2O masers are situated at the edge of the H II regions while the OH masers are outside them and indicate the position of cocoon.

The data are presented, together with arguments that the H II regions are not the result of shocks impinging on interstellar clouds, or the result of UV radiation from a central star shining through tunnels in the interstellar medium. They are believed to be the first observational data on the evolution of protostars onto the Main Sequence.

https://doi.org/10.1017/S0074180900095589 Published online by Cambridge University Press