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THE STAR FORMATION REGION NGC 6334

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RESUMEN

El complejo nebular NGC 6334 contiene varios ejemplos de núcleos de formación estelar extremadamente activa. Éste se encuentra a una distancia de 1.62 kpc del Sol y tiene una masa total de más de $10^5 M_\odot$. Las condiciones físicas que caracterizan cada uno de sus centros activos difieren significativamente de región a región, desde la fase más temprana que se pueda detectar milimétricamente hasta regiones HII bien desarrolladas. Las regiones más viejas están hacia el sur y las más jóvenes se alinean siguiendo un risco molecular. A lo largo de éste, no se aprecia ningún patrón que pueda correlacionar sus edades con su localización.

ABSTRACT

The bright nebular complex NGC 6334 contains some of the most active sites of massive star formation known in our Galaxy. It is located at a distance from the Sun of 1.62 kpc and has a total mass of a few $10^5 M_\odot$. The physical characteristics of the active spots range widely, from well developed expanding HII regions to deeply embedded, still contracting, young objects detected only as millimeter sources, thus at their earliest observable stage of their evolution. The oldest optically visible round HII regions with central O-type stars are found in the southern parts, and the youngest along a molecular ridge. On the latter, no clear spatial evolutionary correlation is apparent.

Key Words: H II regions — stars: formation

1. PANORAMA OF THE COMPLEX NGC 6334

This optical emission nebula, also known as the "Cat's Paw", is one of the most complex natural star formation laboratories known in the Galaxy. It extends $32' \times 40'$ across the sky and is at a distance from the Sun of 1.62 kpc (Persi & Tapia 2008). The visible nebula is ionized by a small number of lightly reddened O-B0 stars. Several distinct active spots are located along a ridge of dense molecular gas. Large-scale surveys in the radio and infrared have identified these very young spots (e.g. Schraml & Mezger 1969; McBreen et al. 1979). Rodríguez et al. (1982) later found that the observed shapes of the radio sources on the molecular ridge could be explained in terms of hydrodynamical models of the evolution of HII regions. Figure 1 shows a composite image of NGC 6334 in the mid-infrared from *MSX* images from 8.3 to 21.3 μm with labels identifying the different active spots.

2. INDIVIDUAL ACTIVE REGIONS

2.1. *NGC 6334 I, I(N), E*

The northeastern part of the molecular ridge of NGC 6334 is the best studied so far and includes two of the youngest regions ever detected. The thermal emission of the cold core I(N) has been detected only at $\lambda > 200\ \mu$m and has a mass of $\sim 2200\ M_\odot$. With a prototrapezium system of five components detected only at 1.2 mm (Hunter et al. 2006), this region is at the earliest detectable phase of the live of a stellar system. It is associated with CH_3OH and H_2O masers and knots of shocked gas (Buether et al 2005; Persi et al. 2005). The far-infrared source I, coincident with the compact HII region F, is an extremely complex source, associated with a similar multiple mm-emitting system as well as near- and far-infrared embedded sources (Tapia et al. 1996), some of them coincident. It drives at least one massive bipolar flow characterized by NH_3 maser and H_2 emission knots and methanol and water masers. Equidistant to those sources, lies the developed radio HII region E, associated with a cluster of embedded infrared near-infrared sources with no masers detected so far in its vicinity (Tapia et al. 1996).

2.2. *NGC 6334 II, IV and V*

The far-infrared source II coincides with the shell radio HII region D. The expansion of which seems to have triggered a new site for the formation of a small star cluster, seen embedded in a dense molecular clump on the western side of the shell. This scenario could well be an appropriate description for

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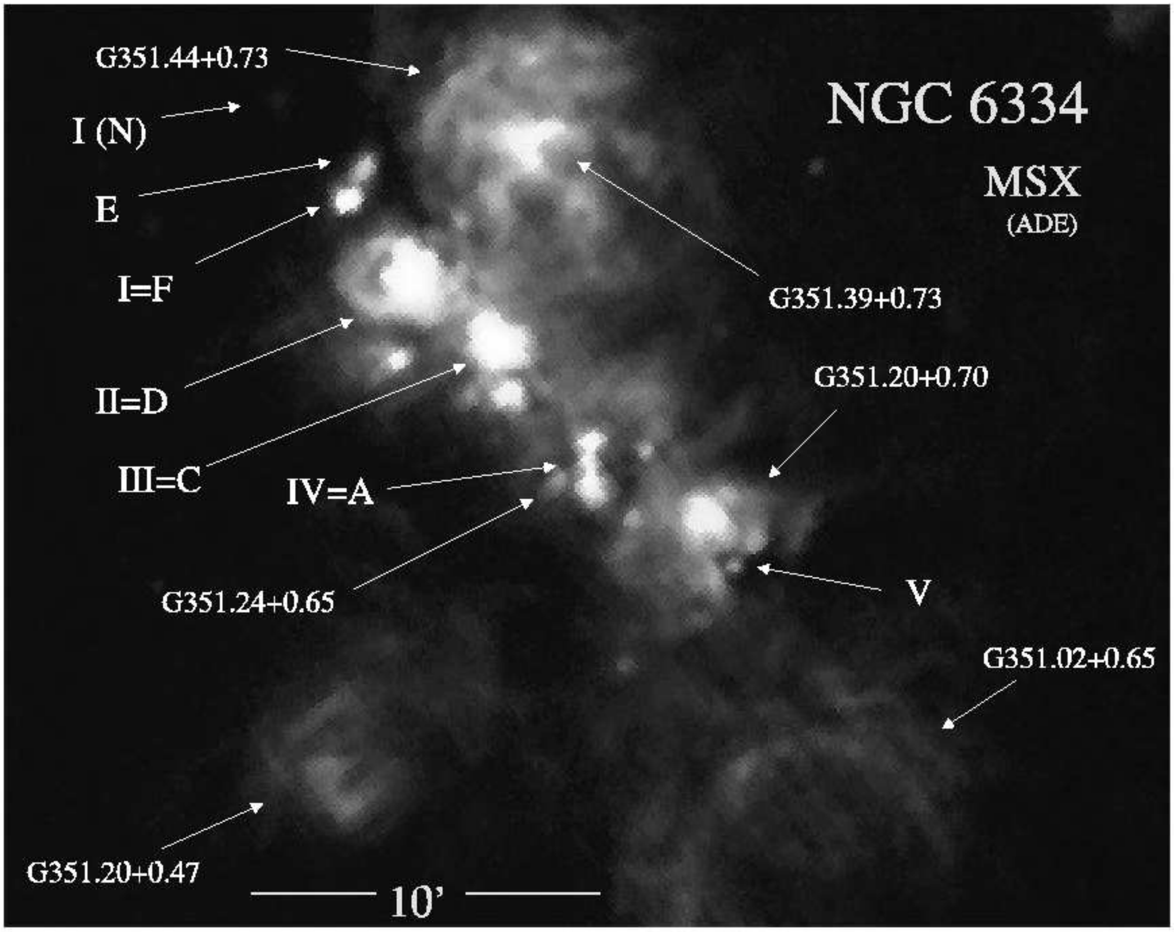

Fig. 1. Composite image of NGC 6334 in the mid-infrared. *MSX* bands A (8.3 μm), D (14.7 μm) and E (21.3 μm). The radio HII regions and mid- and far-infrared sources are labeled according to the adopted identification.

region V, on the southwestern edge of the molecular ridge (Persi & Tapia 2008). Region IV seems to be composed of several molecular clumps with no developed embedded stellar cluster, though many signposts of very recent star forming spots are evident, from compact HII regions to water masers and extended millimeter sources. (Rodríguez et al. 1988; Kraemer et al. 1997; Persi et al. 2000)

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REFERENCES

Beuther, H., Thorwirth, S., Zhang, Q., Hunter, T. R., Megeath, S. T., Walsh, A. J., & Menten, K. M. 2005, A&A, 627, 834

Hunter, T. R., Brogan, C. L., Megeath, S. T., Menten, K. M., Beuther, H., & Thorwirth, S. 2006, ApJ, 649, 888

Kraemer, K. E., Jackson, J. M., Paglione, T. A. D., & Bolatto, A. D. 1997, ApJ, 478, 614

McBreen, B., Fazio, G. G., Stier, M., & Wright, E. L., 1979, ApJ, 232, L183

Persi, P., & Tapia, M. 2008, in ASP. Monographs Vol. 5, Handbook of Star Forming Regions: Volume II, The Southern Sky, ed. B. Reipurth (San Francisco: ASP), 456

Persi, P., Tapia, M., & Roth, M. 2000, A&A, 357, 1020

Persi, P., Tapia, M., Roth, M., Gomez, M., & Marenzi, A. R. 2005, in The Dusty and Molecular Universe: a prelude to Herschel and ALMA, ESA SP-577, ed. A. Wilson (Noordwijk: ESA), 407

Rodríguez, L. F., Cantó, J., & Moran, J. M. 1982, ApJ, 255, 103

__________. 1988, ApJ, 333, 801

Schraml, J., & Mezger, P. G. 1969, ApJ, 156, 269

Tapia, M., Persi, P., & Roth, M. 1996, A&A, 316, 102