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KINEMATICS AROUND THE NON-THERMAL SUPERBUBBLE IN IC 10

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We study the kinematics around a non-thermal superbubble found by Yang & Skillman. Considering the H II and [S II] profiles, we find that between 3 and 6 supernovae are required to form this superbubble.

IC 10 may well be the nearest example of a blue compact dwarf galaxy (BCD). Among the Local Group star-forming dwarf galaxies, IC 10 is conspicuous for having the highest surface density of WR stars (11.2 kpc^{-2}, Richer et al. 2000). The presence of so many WR stars and the high Hα luminosity emphasize that IC10 is currently undergoing a burst of star formation that began at least 10 Myr ago. Observations of 21-cm emission from neutral hydrogen reveal that IC 10 consists of an inner disk embedded in an extended, complex, counter-rotating envelope (Shostak & Skillman 1989). This leads Wilcots & Miller (1998) to conclude that IC 10 is still in its formative stage. These H I observations make clear the youth of the current star formation episode for there is a notable lack of interestellar medium structures attributable to supernovae (Wilcots & Miller 1998). The galaxy size in the light of Hα is 5×3 arcmin while in H I it is 18×15 arcmin. All optical studies of IC 10 are hampered by the large foreground reddening due to its position near the plane of our galaxy ($l = 119°$, $b = -3°$).

Our observations of the non-thermal superbubble, discovered by Yang & Skillman (1993), were obtained in the light of Hα and [S II] with the scanning Fabry-Perot Interferometer, PUMA. We suppose that the energy in the ionized interstellar medium comes from the energy injected by stellar winds and supernovae. Considering both the Hα and [S II] profiles, we find a typical expansion velocity of 50 to 70 km s^{-1}. Using a distance of 661 kpc (Sakai et al. 1999) and a diameter of 41.5$''$ inferred from Yang & Skillman (1993), we calculate a radius of 66 pc for the superbubble. Adopting a density of 1.1 atoms cm^{-3} (Yang & Skillman 1993), the mass swept out by the superbubble is 4.87×10^{37}g (2.45×10^{4} solar masses).

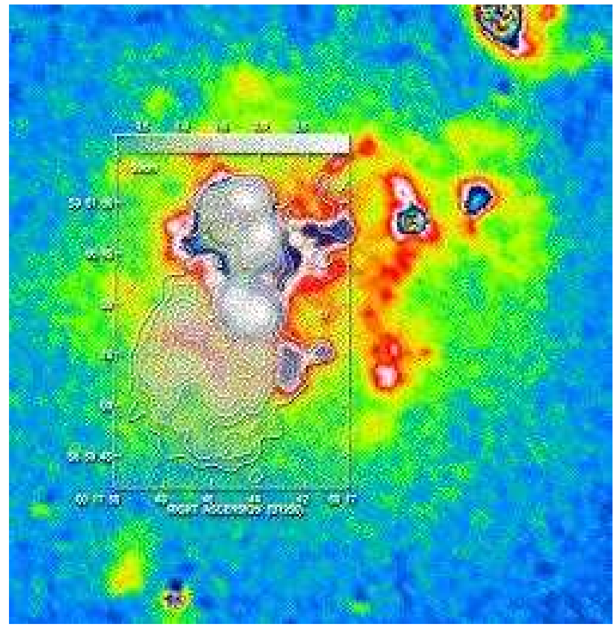

Fig. 1. A close-up of the region of the non-thermal superbubble in Hα with the Yang & Skillman, (1993) isocontours of the 49-cm flux superposed. This image was formed by summing up the velocity channels containing emission from IC 10. The heliocentric velocity of this galaxy is -344 km s^{-1} (de Vaucouleurs et al. 1991).

With these values, the kinetic energy obtained is 6.09×10^{50} to 11.9×10^{50} erg. Supposing that 20% of a supernova's thermal energy is converted into kinetic energy and that each of them injects 10^{51} erg, then from 3 to 6 supernova are required to form this superbubble.

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