RELATIONSHIP BETWEEN GAS CONTENT AND LUMINOSITIES IN VIRGO GALAXIES

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Galaxies in the Virgo cluster offer a convenient distance independent sample for the study of large scale properties of star formation (SF). While the gas is the raw material for SF, the galaxy mass seems to play an important role. The luminosities in various bands are sensitive to stars of different masses (ages) and as such sample SF over different periods of time. For example, the far-infrared (far-IR) luminosity samples recent (few tens of million years) and massive stars, while the blue luminosity samples stars over about billion years. The H band luminosity represents almost the average SF over the life of the galaxy. Relationships between luminosities and gas contents, can then offer clues to the history of SF in the galaxy and its variation from galaxy to galaxy. In order to be free of richness effects, correlations are studied by normalising with M(G), the dynamic mass within the optical diameter of the galaxy. The mass normalised quantities will be referred to as specific mass and specific luminosity.

The data have been taken from published papers and IRAS catalog. The following correlations are found. Both the specific L(IR) and L(B) correlate with specific M(H1) and M(H2). As for the gas masses, while M(H1)/M(G) decreases with M(G), the M(H2)/M(G) ratio increases slightly. The ratio M(H2)/M(H1), therefore, increases as M(G) increases irrespective of the morphological type. The logarithmic means of H2 fraction, H1 fraction and H2/H1 for four Log M(G) intervals (given first) are : 10-10.4, <-1.74, -1.01, <-0.7; 10.4-10.8, -1.78, -1.27, -0.5; 10.8-11.2, -1.88. -1.77, -0.26; 11.2-11.6, -1.58, -1.88, +0.35. As for specific H band luminosity, while it decreases with specific H1 mass, it seems to increase with specific H2 mass. The latter is also true for a sample of non-Virgo galaxies.

Since the gas is the primary fuel for SF it is understandable that the present day SF (IR and B) increases with the availability of gas. However SF over the life of the galaxy, represented by L(H) depends on a higher power of M(G) (Rengarajan and Iyengar, 1989, J. Astrophys. Astron., 9, 79). Hence more massive stars have more specific L(H) and less specific M(H1), since gas is used up in SF. However, if H2 is a product of SF (more metallicity, more dust, more H2) more SF leads to more H2 resuling in the observed dependences of speific M(H2) with M(G) and specific L(H).

F. Combes and F. Casoli (eds.), Dynamics of Galaxies and Their Molecular Cloud Distributions, 412.