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THE *Z*–*L* RELATIONSHIP: SOME CLUES FOR GALAXY EVOLUTION

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Gas–rich dwarf galaxies are probably the best objects to study signatures of a process of self–regulation between the disk and the halo. A qualitative picture about the process of self–regulation follows: in galactic gas halos with a short cooling time, halo clouds will infall ballistically if they are not destroyed by ram pressure due to the interaction with the wind. This fresh gas will activate star formation and the wind until ram pressure is able to reduce the accretion rate, resulting in a self–regulation mechanism. If this process is at work then the b–parameter defined as $b \equiv A/(A - W)$, with A the mass accretion rate and W the rate of mass lost in the wind, should be very constant with time. Here our objective is to check whether simple chemical models that include infall of cooling gas and outflow of hot gas with constant b can explain the variations in metallicity of dwarf galaxies. In particular, we aim to discern whether the b-parameter could be similar for different types of dwarf galaxies, or i.e. on the contrary, each type requires a different A/W-ratio. In order to study the self-regulation conditions, the relationship between the metallicity (Z) and the luminosity (L) is used.

Such a relationship is obtained from the general equations of chemical evolution as described in Tinsley (1980). We consider two different situations: (1) the mass of gas within the galaxy is approximately constant along its life, $M_{\rm g} = {\rm cst}$, (2) the mass of gas changes approximately as the stellar mass does, $M_{\rm g} = \alpha M_{\rm s}^{\gamma}$.

The metallicity and luminosity of a sample of gas-rich dwarf galaxies were selected from the literature, including blue compact, Magellanic irregular and dwarf irregular galaxies. These different types of galaxies present different values of the mass–luminosity ratio, q, depending on its current star-formation activity. It is expected that some galaxies in the sample are formed inside out, and others by keeping the mass of gas constant, but there is no reason to assume that there is a one-to-one correspondence between each type of galaxy and each model. In Fig. 1 different theoretical curves in the Z–L diagram were plotted together with the data points. First of all, it turns out that all the galaxies in the sample are populating the same locci in the Z–L diagram, which may suggest that they are not deeply different in nature (e.g., in their formation) with the surface brightness as the only differing quantity. Second, for a given set of parameters this relationship is not linear but saturates exponentially (Hidalgo-Gámez et al. 2002). Third, both models can successfully explain the range of metallicities with a single value of b, the M/L–ratio being enterily responsible for the apparent scatter. However, model 1 requires $b \approx 2$ whereas model 2 requires $b \approx 1.2$. Therefore, if different galaxies evolve according to different models, b must also reajust itself to the different conditions.

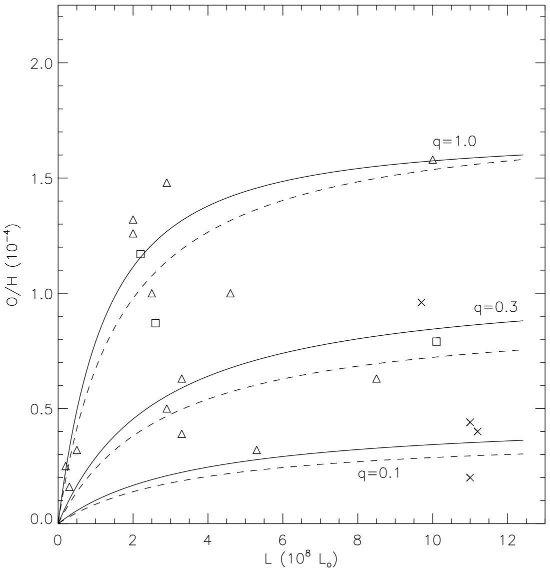

Fig. 1. The Z–L diagram. Data on dwarf irregulars are represented by triangles, blue compacts by squares and crosses stand for magellanic irregulars. The solid lines correspond to model 1, with $b = 2$, and the dashed lines correspond to model 2, with $\gamma = 1$ and $b = 1.2$, for three different values of q.

REFERENCES

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