Star formation and gas flow history of a dwarf irregular galaxy traced by gas-phase and stellar abundances

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According to the cold dark matter model[1], larger systems are assumed to be formed by mergers of smaller systems. Thus, studying the evolution of low-mass galaxies can provide insights into characteristics of systems that can be building blocks of a massive galaxy. Elemental abundances of galaxies carry the information about the history of the star formation and gas flows. Previous studies on star-forming dwarf galaxies using chemical evolution models explain the properties by physical processes, such as galactic wind and/or discontinuous star formation[2]. Many of these studies compare their models to gas-phase or stellar abundances, and there seems to be still room to discuss the evolution of individual galaxies based on both abundances.

This study attempts to study the history of star formation and gas flows of a dwarf irregular galaxy in the Local Group using chemical evolution models from the viewpoints of gas-phase and stellar elemental abundances. Observed gas-phase oxygen abundance, stellar metallicity distribution and gas fraction are compared to four models in which continuous and smooth star formation, gas accretion and/or outflow are taken into account. Because the gas fraction decreases, the outflow seems to be a dominant process. On the other hand, the width of metallicity distributions predicted by the models tends to be narrow compared to that of observed distribution. The result suggests that the observed properties of the galaxy may be explained by temporal variation in star formation activities and/or gas flows, which is not described in the models.

[1] White S. D. M., Rees M. J., 1978, MNRAS, 183, 341

[2] Tosi M., 1998, in Thuan T. X., Balkowski C., Cayatte V., Tran Than Van J., eds, XVIIIth Rencontre de Moriond