OXYGEN ABUNDANCES IN DIFFUSE ELLIPTICALS AND THE METALLICITY-LUMINOSITY RELATION FOR DWARF GALAXIES

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Using theoretical models of the planetary nebula populations in galaxies, we investigate whether the current oxygen abundances in bright planetary nebulae can be used to predict the oxygen abundance that persisted in the interstellar medium when star formation stopped. In all galaxies, these models predict that a gap develops between the abundances observed in bright planetary nebulae and those that persisted in the interstellar medium when star formation stopped. This abundance gap depends primarily upon the oxygen abundance achieved in the interstellar medium when star formation stopped, though it also has some sensitivity to the history of star formation. The gap is always less than 0.5dex in these models. For the Milky Way, the predicted abundance gap, 0.14dex, is identical to that observed. The abundance gap magnifies the abundance-related differences between diffuse ellipticals and dwarf irregulars found by Richer & McCall (1995, ApJ, 445, 642). Diffuse ellipticals are confirmed to have larger oxygen abundances than similarly luminous dwarf irregulars, and to have larger [O/Fe] ratios than dwarf irregulars with the same oxygen abundance. The simplest explanation for both of these observations is that diffuse ellipticals formed on shorter time scales than dwarf irregulars. Given this difference in the history of star formation, diffuse ellipticals cannot be the faded remnants of dwarf irregulars.

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