

Measurement of a dwarf galaxy rotational velocity from its Lyman-alpha line emission

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Abstract

The Lyman-alpha emission line is a strong indicator of star formation. Observations of this line are central to construct samples of the most distant star forming galaxies, which in turn are useful for studies in cosmology and galaxy evolution. The interpretation of Ly- α observations has to go together with computational models for the radiative transfer of Lyman-alpha photons. Recent theoretical work suggested that galaxy rotation should have a measurable impact on the shape of the Lyman-alpha line. Here we show that galaxy rotation can be measured from the Lyman-alpha line profile. We found that Lyman-alpha observations of a dwarf galaxy (Tol 1214-277) in the local universe, which had previously evaded theoretical interpretation, are naturally explained by rotational effects. We constrain the rotational velocity, viewing angle and total neutral hydrogen mass from the Lyman-alpha observations. These values are in agreement with other observational constraints. Our results present a new observational method by which the rotational velocity of a dwarf galaxy can be estimated. Considering the expected similarities between the local and the most distant dwarf galaxies, we anticipate that the Lyman-alpha line could be used to constrain the kinematic state of the highest redshift galaxies to be detected with next generation infrared spectroscopic facilities such as the James Webb Space Telescope.