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

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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 intepretation 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 report that lyman-alpha observations of a dwarf compact 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 broad agreement with other observational constraints, although they raise questions about the rather atypical nature of such source. 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 constraint the kinematic state of the highest redshift galaxies to be detected with next generation infrared spectroscopic facilities such as the James Webb Space Telescope.

1. General paragraph about the Lyman alpha line.
2. General paragraph about modelling the Lyman alpha line. Outflows.
3. Rotation and the expected features.
4. The charachteristics of the dwarf galaxy of interest.

TOL1214-277 Blue Compact Dwarf Galaxy

Star forming galaxy, no old stars.

5. The results of the fit.

Figure 1. Observed line + fit.

We estimate the total neutral hydrogen mass to be $M \approx m_H \tau^3 \sigma^{-3} n^{-2}$, where m_H is the mass a Hydrogen's atom, τ is the optical depth and n is the number density of neutral Hydrogen atoms. For this system we estimate that for average values of $n = 1 \times 10^3$ the total hydrogen mass is $M \times 10^{14}\mathrm{M}_{\odot}$. However, blind HI surveys have put an upper limit in the neutral hydrogen mass of ???

7. Implications for outflow+rotation in existing samples.
8. Implications for very high-z dwarf galaxies.