Mon. Not. R. Astron. Soc. **000**, 000–000 (0000) Printed 28 March 2017 (MN LaTeX style file v2.2)

Outflows and rotation in Lyman alpha galaxies

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28 March 2017

ABSTRACT
Star-forming Compact Dwarf Galaxies (CDGs) resemble the expected pristine conditions of the first galaxies in the Universe and are the best systems to test models on primordial galaxy formation and evolution. Here we report on one of such CDGs,

Key words: galaxies: dwarf — galaxies: individual:Tololo 1214-277 — radiative transfer — Methods: numerical

1 INTRODUCTION

Distant galaxies are key to understand early evolutionary stages of our Universe. Physical conditions in those galaxies allows the emergence of Lyman-α line emission at 1216 Å**?**. Galaxies detected through its Lyman-α emission receive the name of spectra at and named Lyman Alpha Emitters (LAEs).

Currently LAEs are commonly targetted in wide area galaxy surveys. They have been effectively used to study galaxy evolution, cosmology and the thermal history of the Universe. This has been able through the study of their spatial distribution and the shape of the Lyαemission line.

Recent imptovements in instrumentation have revolutionized the kind of studies that can be performed on LAEs. It is now possible to infer detailed kinematic maps for nearby galaxies. The study of these maps would allow us to build data-driven models to interpret the Lyαspectra of unresolved galaxies, helping us to constrain the physical conditions of the interstellar medium (ISM) processing the Lyαradiation.

On the ISM's features that plays an important role in shaping the Ly$\alpha$is HI kinematics. In a static HI medium the Lyαline has two equal and symmetric peaks around the natural Lyαwavelength and zero intensity at the line's center. For an outflowing ISM, the line becomes asymmetrical with a more pronounced read peak. If the galaxy rotates, the line shows different amounts of Doppler shifts modifying the overall line profile Garavito-Camargo et al. (2014).

In this paper we present for the first time a study of the joint effects of galaxy outflows and rotation. We study a simplified geometrical configuration corresponding to an spherical gas cloud with symmetrical radial outflows and a rotation profile corresponding to a solid body. We base our modelling on a Monte-Carlo radiative transfer code called CLARA (Code for Lyman Alpha Radiation Analysis) presented for the first time in Forero-Romero et al. (2011). Besides modelling the impact of joint rotation and outflows, we also want to check to what extent the analytical model presented by Garavito-Camargo et al. (2014) to explain the effects of rotation can also be applied in our case.

In this paper we introduce first our theoretical tools and assumptions in Section 2, then we present the numerical results and comparisons against the analytical solution in 3. In Section 4 we discuss our results and their possible implications for observational analysis to finally present our conclusions in Section 5.

2 THEORETICAL MODELS

2.1 Monte-Carlo Radiative Transfer Model

2.2 Analytical Model for Bulk Rotation

3 RESULTS

3.1 Monte-Carlo Radiative Transfer Model

3.2 Analytical Model for Bulk Rotation

4 DISCUSSION

4.1 Theoretical Insights

4.2 Observational Perspectives

5 CONCLUSIONS

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