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Spatially resolved Lyman-alpha emission from a virtual dwarf galaxy

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Abstract. In the context of the first light of MUSE, Integral Field Unit (IFU) spectrograph of second generation installed recently at VLT, we compute mock IFU Lyman-alpha (lyα) observations of a virtual dwarf galaxy, to help understanding and interpreting forthcoming observations. This study is an extension of the work carried out in Verhamme *et al.* (2012), where we studied the spatially integrated lyα properties of a dwarf galaxy. With the same data, we now investigate the spatial variations of lyα spectra.

Keywords. Radiative transfer – Galaxies: ISM – ISM: structure, kinematics and dynamics

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1. Context

The study of spatially resolved lyα properties of galaxies is a *recent* domain: at low redshift, the spatial extend of lyα emission around starforming galaxies is known for less than 10 years (Hayes *et al.* 2005; Östlin *et al.* 2009; Hayes *et al.* 2013). The existence of similar lyα halos around high-redshift galaxies has been reported recently (Steidel *et al.* 2011; Matsuda *et al.* 2012; Momose *et al.* 2014). Newly available IFU facilities will allow to study not only their spatial extent and surface brightness, but also their gas content and kinematics, in lyα. Because of strong radiation transfer effects, models are needed to interpret the forthcoming data.

2. Results

The spatially resolved lyα profiles from our simulated dwarf galaxy vary from pixel to pixel. When the galaxy is seen face-on, the lyα spectrum emerging from the central pixel, directly from the star-forming region, has a usual asymetric, redshifted shape, whereas the surrounding pixels show spectra emerging in the diffuse Lyα halo with non-zero lyα flux on the blue side of the line. When the galaxy is seen edge-on, the 3 central pixels, aligned with the galactic disk, show an unusual double-peaked lyα profile asymetric towards the blue, tracing gas infall; whereas the other pixels show more common double-peaked spectra but with a prominent red peak, tracing gas outflow. However, the number of photons emerging per pixel on the edge-on view is small, the histograms are then noisy and less reliable than face-on.

The lyα spectra emerging from different pixels do not trace the velocity of the gas at the location of escape but they rather seem to trace the bulk velocity field along the path from the lyα sources to the last scattering. Further analyse has to be done to confirm this trend. A strong limitation of this study is the idealised halo in which the galaxy forms, which may be far from producing a realistic cosmological environment.

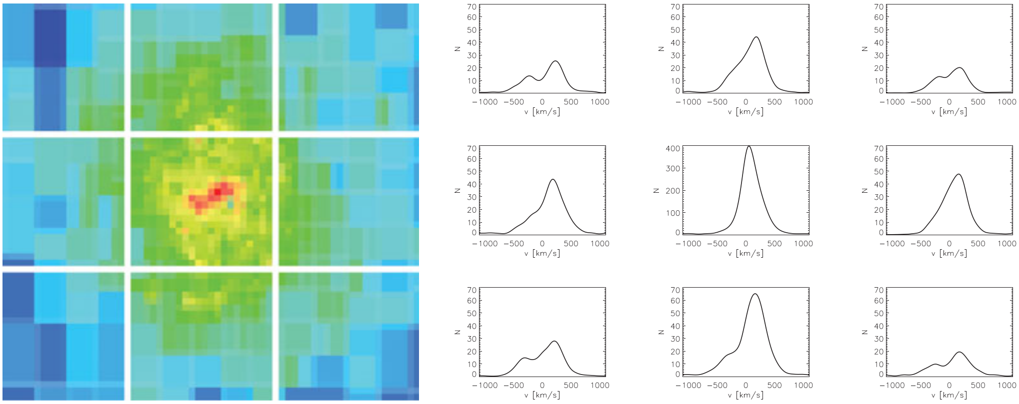

Figure 1. Lyα spectra from 9 pixels of the central 3×3 kpc of a dwarf galaxy seen face-on, smoothed at the spectral resolution of MUSE (R=4000). The image on the right shows the correponding ly$alpha$ image.

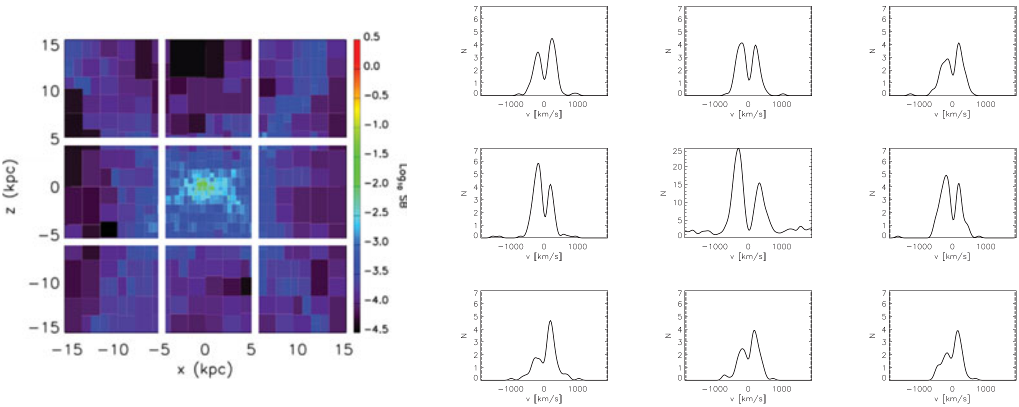

Figure 2. Lyα spectra from a dwarf galaxy seen edge-on, smoothed at MUSE spectral resolution. The image on the right shows the correponding ly$alpha$ image divided in 9 pixels from which we extracted the spectra.

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