Formation and Evolution of Galaxy Outskirts
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Recent star formation in the H I dominated outer regions of early-type galaxies

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Abstract.
Context. According to the ATLAS^{3D} project, about 20 percent of all nearby early-type galaxies (D < 42 Mpc; M_K < -21.5 mag; stellar mass $M_{stars} \gtrsim 6 \times 10^9$ $M_\odot$) outside clusters are surrounded by a disc or ring of low-column-density neutral hydrogen (H I) gas with typical radii of tens of kpc, much larger than the stellar body.
Aims. Our aim is to understand the impact of these gas systems on the host galaxies, in particular, whether there is any recent star formation related to the H I and effect of recent star formation on the host early-type galaxies.
Methods and sample. We analyse the distribution of star formation out to large radii by using resolved H I images together with UV and optical images. We calculate the UV-UV and UV-optical colours in two apertures, 1-3 and 3-10 $R_{\rm eff}$. Using FUV emission as a proxy for star formation, we also estimate the integrated star formation rate in the outer regions. Our sample consists of 18 H I-rich galaxies as well as 55 control galaxies where no H I has been detected. We select the control sample galaxies to match the H I-rich galaxies in stellar mass, environment, distance and stellar kinematics.
Results. In half of the H I-rich galaxies the radial UV profile changes slope at the position of the H I radial profile peak. We find that the FUV-NUV and UV-optical colours in the first and second apertures of the H I-rich galaxies are on average 0.5 and 0.8 mag bluer than the H I-poor ones, respectively. We also find that the H I-rich early-type galaxies have colour gradients that are almost 2 times stronger than the H I-poor ones. we estimate the integrated star formation rate in the outer regions ($R > 1$ $R_{\rm eff}$) to be on average $\sim 6.1{\times}10^{-3}$ $M_\odot$ yr^{-1} for the H I-rich galaxies. We find that the gas depletion time in the outermost region (3-10 $R_{\rm eff}$) is $\sim$ 80 Gyrs, which is similar to that estimated for the outskirts of spirals.
Conclusions. Studying the stellar populations in early type galaxies with and without H I, we find that galaxies with H I generally show UV and UV-Optical colours in the outer parts that are bluer than those of early-type galaxies without H I. This shows that the H I is actively involved in recent star formation. The star formation rate in the outer regions is too low to build a stellar disc, and therefore change the morphology of the host even when integrated over several Gyrs. Star formation in outermost regions does not depend on the type of the galaxies.

Keywords. galaxies: elliptical and lenticular, cD, galaxies: evolution, galaxies: ISM, galaxies: structure

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