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Fountain-driven Accretion of Gas on to nearby Spiral Galaxies

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It is widely accepted that disc galaxies sustain their star formation by accreting gas from the external environment. In this study, we focus on one possible mechanism: hot CGM (corona) condensation triggered by the galactic fountain. Supernova feedback in star-forming galaxies continuously ejects out the plane part of the disc gas, which travels in the halo and falls back to the disc. This gas cycle, known as the galactic fountain, brings to the halo region metal-rich and cold gas, which then interacts with the coronal gas and significantly reduces its cooling time, leading to condensation and accretion. The cooling of part of the corona leaves a trace in the gas kinematics at the disc-halo interface that has been modelled in the Milky Way returning a prediction for the accretion rate very close to the Galactic star formation rate (SFR). However, whether the scenario can be extended to other spiral galaxies is unknown. We use a dynamical model of the fountain-driven corona accretion to simulate the neutral extraplanar gas (EPG) in the nearby galaxy NGC 2403 using data from the HALOGAS survey. The EPG emissions can be reproduced by our dynamical model. The accretion rate from corona condensation inferred for NGC 2403 is 0.5 M☉/yr, very consistent with the star formation rate (0.6M☉/yr). These results, combined to a previous kinematic study of the whole HALOGAS sample, indicate that fountain-driven corona condensation as a promising mechanism to sustain star formation in local disc galaxies. Our model also predicts the radial profile of the accretion rate, with peaks at R˜4 kpc for NGC 2403. Given that SFR of NGC 2403 peaks in the centre this shift of the accretion peak suggests a potential inside-out redistribution of gas and star formation activities in the future.

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