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Probing low surface-brightness populations with cosmological simulations

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Cosmological simulations provide an alternative way of probing populations of low-surface-brightness (LSB) objects, which make up the majority of galaxies in the Universe, but which remain poorly studied observationally. Making predictions for this sub-set of the galaxy population is important, since our current understanding of galaxy evolution is underpinned by the parts of the galaxy population that we can observe (most galaxies with surface brightnesses below 23 mag/square arcsec are not seen in SDSS for example). This population appears particularly important since our predictions indicate that a significant majority (>85 per cent) of galaxies may reside in the LSB regime and that significant extreme populations of LSB galaxies (e.g. UDGs) exist even outside of clusters in line with recent observational results (Sedgwick+19). Using the Horizon-AGN and New Horizon simulations, we have probed the formation of LSB galaxies, showing that LSB and UDG galaxies may be descended from populations with almost identical properties to their high-surface-brightness analogues. UDGs are produced principally as a consequence of interactions, regardless of environment. In part, the shallower matter density slopes of LSB galaxies, which are a consequence of their early formation (assembly bias), contribute to allowing tidal processes / interactions to work more efficiently.

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