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How did dwarf galaxies end up compact?

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Using the IllustrisTNG-50 (TNG50) cosmological hydrodynamic simulation, we explore the evolution of the most massive progenitors of dwarf galaxies in order to understand how some of these galaxies end up compact. We split the TNG50 dwarfs into a control sample (*Normals*, that follow the the main trend in the z=0 size-mass relation) and in two compact populations: the lower envelope of this main trend (*Compacts*$_{\rm MB}$), and galaxies with stellar half-mass radius ($r_{1/2,*}$) lower than $\sim$ 450 pc (*Compacts*$_{\rm SB}$). We also divided our sample between those galaxies that end up as centrals and satellite galaxies. We explore the evolution of different galaxy parameters and compare between the populations to understand what drives the corpulence of compact dwarf galaxies.

In terms of the size ($r_{1/2,*}$) evolution, *Compacts* and *Normals* present similar sizes before $z \sim 0.8$, when the former population starts to shrink (top panel in Figure 1). We verify that, in the TNG50, this decreasing in size is related to a higher inner specific star formation rate (sSFR within $r_{1/2,*}$), especially for *CompactSBs* that present almost constant inner sSFR between $z \sim 1.7$ to ~ 0.45 (central panel in Figure 1). Besides the higher inner sSFR, *Compacts* present concentrated star formation (bottom panel in Figure 1): they form more stars within $r_{1/2,*}$ than in the outer regions.

In the first paper resulting from this work (De Almeida et al., 2024) we show that *Compacts* present a lack of mergers, especially at late times, related to a lower density environment. This allows an efficient gas infall that favors the concentrated star formation. In a future paper (de Almeida et al. in prep) we discuss the different scenarios for the dwarf satellite galaxies to become compact, which include concentrated star formation and also environment interactions (e.g. ram pressure and tidal stripping).

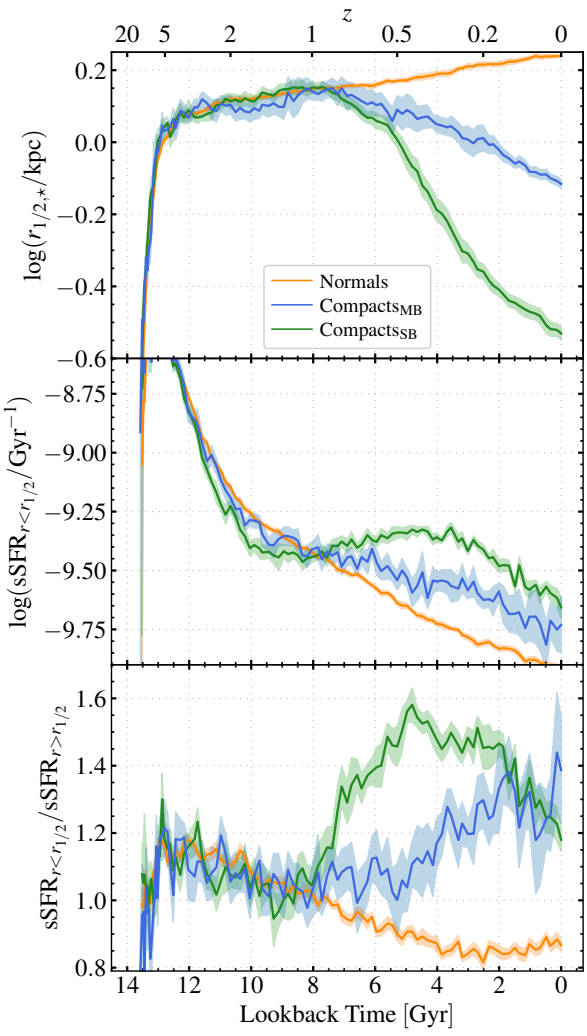

Figure 1. Median evolution of the stellar half-mass radius (**top**), inner sSFR (**center**) and inner over outer sSFR (**bottom**) versus lookback time; for the three populations.

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