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The ATLAS3D Project-- VIII: Modelling the Formation and Evolution of Fast and Slow Rotator Early-Type Galaxies within ΛCDM

Sadegh Khochfar, Eric Emsellem, Paolo Serra, Maxime Bois, Katherine Alatalo, Roland Bacon, Leo Blitz, Frederic Bournaud, Martin Bureau, Michele Cappellari, Roger L. Davies, Timothy A. Davis, P. T. de Zeeuw, Pierre-Alain Duc, Davor Krajnovic, Harald Kuntschner, Pierre-Yves Lablanche, Richard M. McDermid, Raffaella Morganti, Thorsten Naab, Tom Oosterloo, Marc Sarzi, Nicholas Scott, Anne-Marie Weijmans, Lisa M. Young

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We propose a simple model for the origin of fast and slow rotator early-type galaxies (ETG) within the hierarchical ΛCDM scenario, that is based on the assumption that the mass fraction of stellar discs in ETGs is a proxy for the specific angular momentum expressed via λ_R. Within our model we reproduce the fraction of fast and slow rotators as a function of magnitude in the \atl survey, assuming that fast rotating ETGs have at least 10% of their total stellar mass in a disc component. In agreement with \atl observations we find that slow rotators are predominantly galaxies with $ M_* > 10^{10.5}$ M$_{\odot}$ contributing $\sim 20%$ to the overall ETG population. We show in detail that the growth histories of fast and slow rotators are different, supporting the classification of ETGs into these two categories. Slow rotators accrete between $\sim 50% -90%$ of their stellar mass from satellites and their most massive progenitors have on average up to 3 major mergers during their evolution. Fast rotators in contrast, accrete less than 50% and have on average less than one major merger in their past.

We find that the underlying physical reason for the different growth histories is the slowing down and ultimately complete shut-down of gas cooling in massive galaxies. Once cooling and associated star formation in disc stops, galaxies grow via infall from satellites. Frequent minor mergers thereby, destroy existing stellar discs via violent relaxation and also tend to lower the specific angular momentum of the main stellar body, lowering λ_R into the slow

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rotator regime. Abridged...

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