Reconstructing the star formation history of massive early-type galaxies in local galaxy clusters, through the combination of their UV and Hα emission.

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Abstract: Understanding the formation of massive early-type galaxies (ETGs) poses a significant challenge in galaxy mass assembly and is closely tied to the evolution of the Universe as outlined by the Λ Cold Dark Matter model. Within this context, we are reconstructing the star formation histories of the most massive ETGs in local galaxy clusters. We analysed their spatially resolved stellar population (SP) properties including their ultraviolet (UV) and Hα emission. We used deep, narrow-band CFHT Hα images to select ETGs that show no signs of ongoing star formation. We report here results for seven Virgo galaxies (as part of the Virgo Environmental Survey on Ionized Gas Emission, VESTIGE) and preliminary results for other seven galaxies in the Perseus clusters, all more massive than 10^{10} $M_{\odot}$.
We combined CFHT/MegaCam images with Astrosat/UVIT, GALEX, and spectacular Euclid images of the Perseus cluster, to analyse the radial spectral energy distributions (SEDs) of ETGs from the far-UV (FUV) to the near-infrared. The UV emission in these galaxies is likely due to old, low-mass stars in post main sequence (MS) phases, the so-called phenomenon of the UV upturn. We fitted the radial SEDs through the code CIGALE, by implementing novel SP models that include an old, hot stellar component of post-MS stars with various temperatures and energetics. This way, we explored the main stellar parameters responsible for UV upturn stars regardless of their evolutionary path. Standard models are not able to reproduce the galaxies' central FUV emission (SMA/Reff<1), while the new models well characterise it through post-MS stars with temperatures T>~25000 K.
Our results show that these ETGs formed with star formation timescales < 1500 Myr, having assembled between ~40-90% of their stellar mass at z~5. This aligns with new JWST observations of quiescent galaxies at high redshift, and therefore corroborates a consistent picture where massive quiescent galaxies formed and quenched with extreme starbursts and rapid mass assembly.