

Galaxy morphology from bulge and disk decomposition of galaxies at $z \leq 1$ in the Euclid ERO-Perseus images

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The Hubble sequence has been observed to be in place as early as 1 billion years after the Big Bang (Ferreira et al. 2023). Thanks to its high spatial resolution and wide field of view, Euclid will enable the morphological analysis of billions of galaxies up to redshifts $z \sim 3$ (Euclid Collaboration et al. 2022), hence to retrace the history of the Hubble sequence over cosmic times.

The ERO-Perseus data allows us to test the ability of Euclid images to characterize galaxy morphology and to obtain preliminary results regarding morphological evolution. In this study, we perform multi-band luminosity model-fitting of the VIS and NISP-Y, J, H images with the SourceXtractor++ software (Bertin et al. 2020; Kümmel et al. 2022), which is used in the parametric fits implemented in the pipeline of the Organisational Unit MER of the Science Ground Segment (to be described in a forthcoming article), and whose efficiency was demonstrated in the Euclid Morphology Challenge (Euclid Collaboration et al. 2023). We perform and analyse the results of several model-fitting runs, using either a single Sérsic profile (Sérsic 1963), or decomposing galaxies as the sum of a Sérsic bulge and an exponential disc. Examining multi-variate distributions of galaxy, bulge and disk properties, we assess the reliability of the fits and derived structural parameters as a function of apparent magnitude in this first Euclid data, in the light of the results for simulated galaxies obtained in the Euclid Morphology Challenge (Euclid Collaboration et al. 2023). We are then able to provide robust model-fitting photometry and we bring to light biases between adaptive aperture and model photometry, as well as between different configurations of model photometry, depending on the morphology of the galaxies.

Finally, to build upon the results of Quilley & de Lapparent (2022) that highlighted the Hubble sequence as an inverse evolutionary sequence, along which bulge growth and disk reddening are indicators of the quenching of galaxies, we derive preliminary variations of bulge and disk fluxes, colors and sizes as a function of redshift out to $z \sim 1$.

References

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