Unlocking the low surface brightness Universe with Euclid: performance, validation, and early science

The study of low surface brightness (LSB) structures has long been limited by instrumental systematics, background stability, and the difficulty of preserving diffuse emission through data processing. This presentation provides a quantitative assessment of the LSB performance of Euclid based on end-to-end analyses, showing that its optical design, stable space-based conditions, and controlled systematics deliver unprecedented sensitivity to extended faint emission in the optical and near-infrared. Through methodologies developed for the first Euclid science results (2024), using Early Release Observations, Euclid achieves surface brightness limits and spatial uniformity beyond previous wide surveys, while preserving the fidelity of diffuse structures across large angular scales. We detail how this performance is measured, validated, and translated into robust detection limits for Galactic cirrus, stellar haloes, tidal features, intracluster light, and ultra-diffuse galaxies. With its Wide survey (2024–2029), Euclid enables, for the first time, homogeneous and statistically robust measurements of faint structures across cosmological volumes.

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