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Morphology of $z \sim 1$ galaxies from deep K-band AO imaging

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Abstract. We present the results of observations of distant galaxies ($z \sim 0.8$) at high spatial resolution ($\sim$0.1"). We observed 7 fields of $1' \times 1'$ with the NACO Adaptive Optics system (VLT) in Ks ($2.2\mu m$) band with typical $V \sim 14$ guide stars and 3h integration time per field. Observed fields are selected within the COSMOS survey area. We analyze the morphologies by means of B/D (Bulge/Disk) decomposition with GIM2D and CAS (Concentration-Asymmetry) estimators for 79 galaxies with magnitudes between $K_s = 17 - 23$ and classify them in three main morphological types (Late Type, Early Type and Irregulars). We obtain for the first time an estimate of the distribution of galaxy types at redshift $z \sim 1$ as measured from the near infrared at high spatial resolution.

Keywords. infrared, galaxies, morphology, adaptive optics

One classical observational way to test evolution models is classifying galaxies according to morphological criteria defined in the nearby Universe that can be related to physical properties and to follow this classification across time. Near infrared observations are particularly important because the K band flux is less dependent on the recent history of star formation, which peaks in the UV in rest frame, and gives thus a galaxy type from the distribution of old stars, more closely related to the underlying total mass than optical observations. However, no morphological information can be found in the numerous K-band surveys because of the seeing limited resolution. Adaptive optics (AO) installed on ground based telescopes seems the only way today to obtain near-infrared high resolution data.

In this work, we obtain, for the first time an estimate of the mix of morphological types of the galaxy population up to $z \simeq 1$ from ground based K-band observations with high spatial resolution comparable or better to visible imaging from space. We demonstrate that estimating morphology from K-band data at $z \simeq 1$ is not affected by *morphological k correction*, as there is no significant difference between our population and the corrected I-band population. Despite the still small sample at hands, the galaxy counts are demonstrated to be in good agreement with previous works. We find that the fraction of irregulars at $z \simeq 1$ is about $24\% \pm 2.8\%$ using automated classification methods. This is higher than what is found in local surveys, confirming the well established trend of an increasing fraction of irregular galaxies with redshift as observed from surveys in the visible. Our small sample does not allow to reach firm conclusions on the evolution of the fraction of late-type or early-type galaxies, but classifying galaxies from K-band AO imaging data is demonstrated to be reliable.