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Successful application of PSF-R techniques on SPHERE/ZIMPOL observations of the globular cluster NGC6121

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Precise stellar photometry and astrometry require the best possible modelling of the point spread function (PSF). To date, the best performances have been obtained when building the PSF directly from the image of dense stellar fields, exploiting the fact that each star represents a different realisation of the same PSF. The recent advent of the Adaptive Optics technique makes this method more challenging, because of the strong PSF variations accross the field of view. One alternative is to use PSF-reconstruction techniques, that rely on Adaptive Optics control loop data to determine the shape of the PSF at any spatial location. Despite being theoretically well established, so far PSF-R has never surpassed the performance obtained by standard methods when applied to real astronomical imaging. Here we report on the first successful use of PRIME, a new technique that combines both PSF-R and image fitting, to perform precise photometry and astrometry on real data of the Galactic globular cluster NGC6121, observed with SPHERE/ZIMPOL. Compared to the results obtained using standard techniques, PRIME achieves improvement in precision by up to a factor of four. These results thus pave the way for the exploitation of PSF-R techniques to investigate resolved stellar population science cases with future Adaptive Optics-assisted instrumentation like the Extremely Large Telescopes and MAVIS.

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