

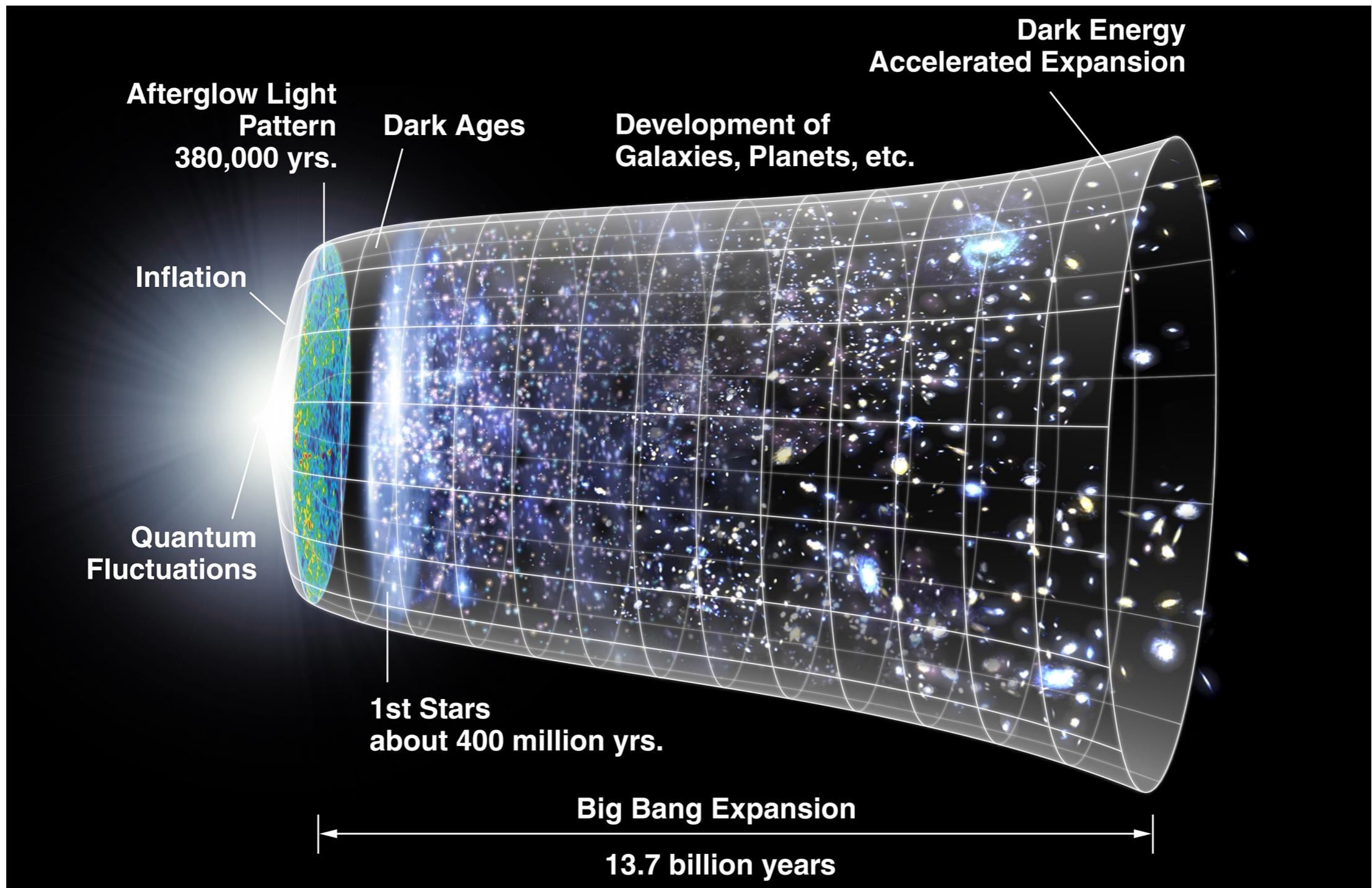
Fast Point Spread Function Modeling with Deep Learning

Jörg Herbel

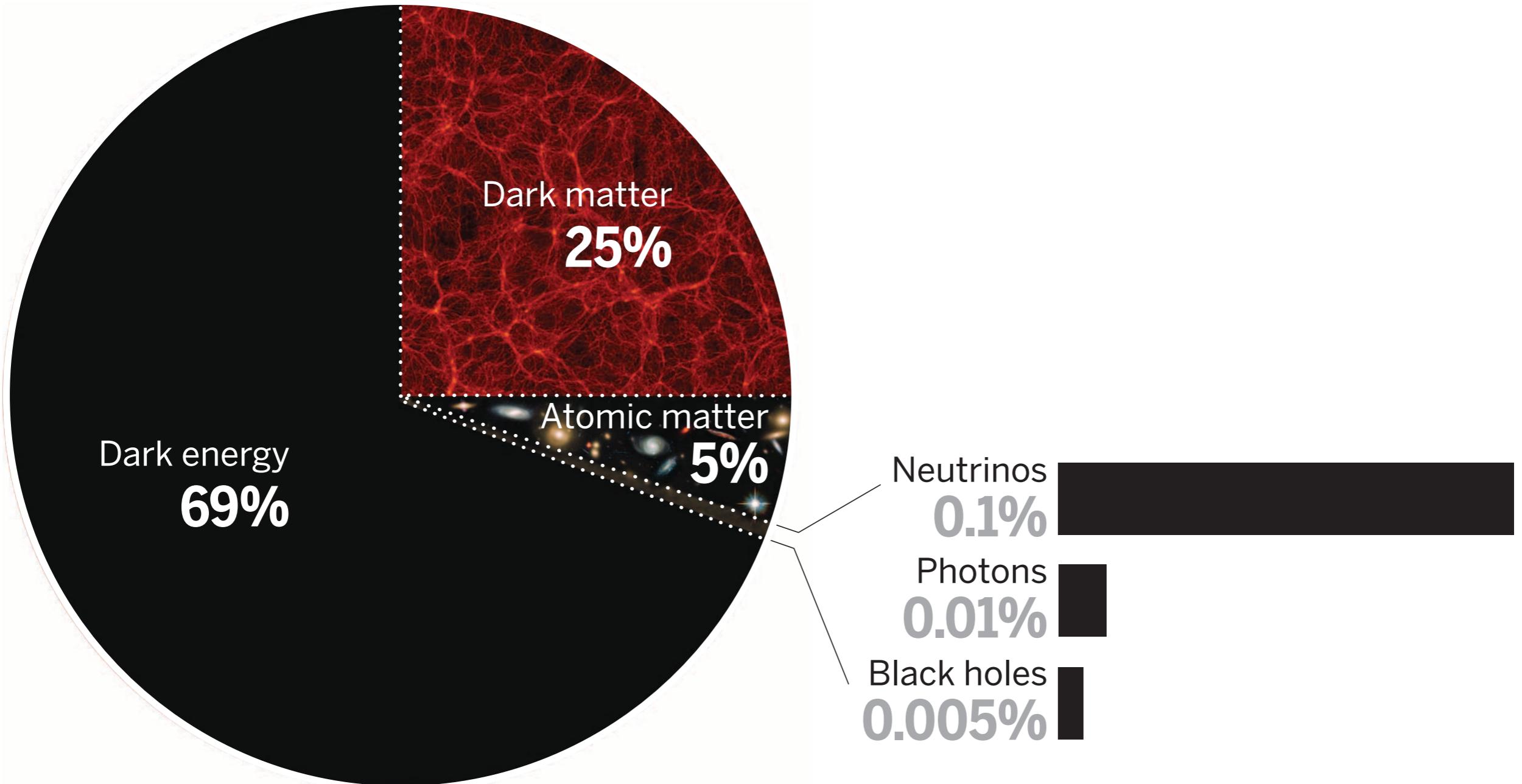
24.04.2018



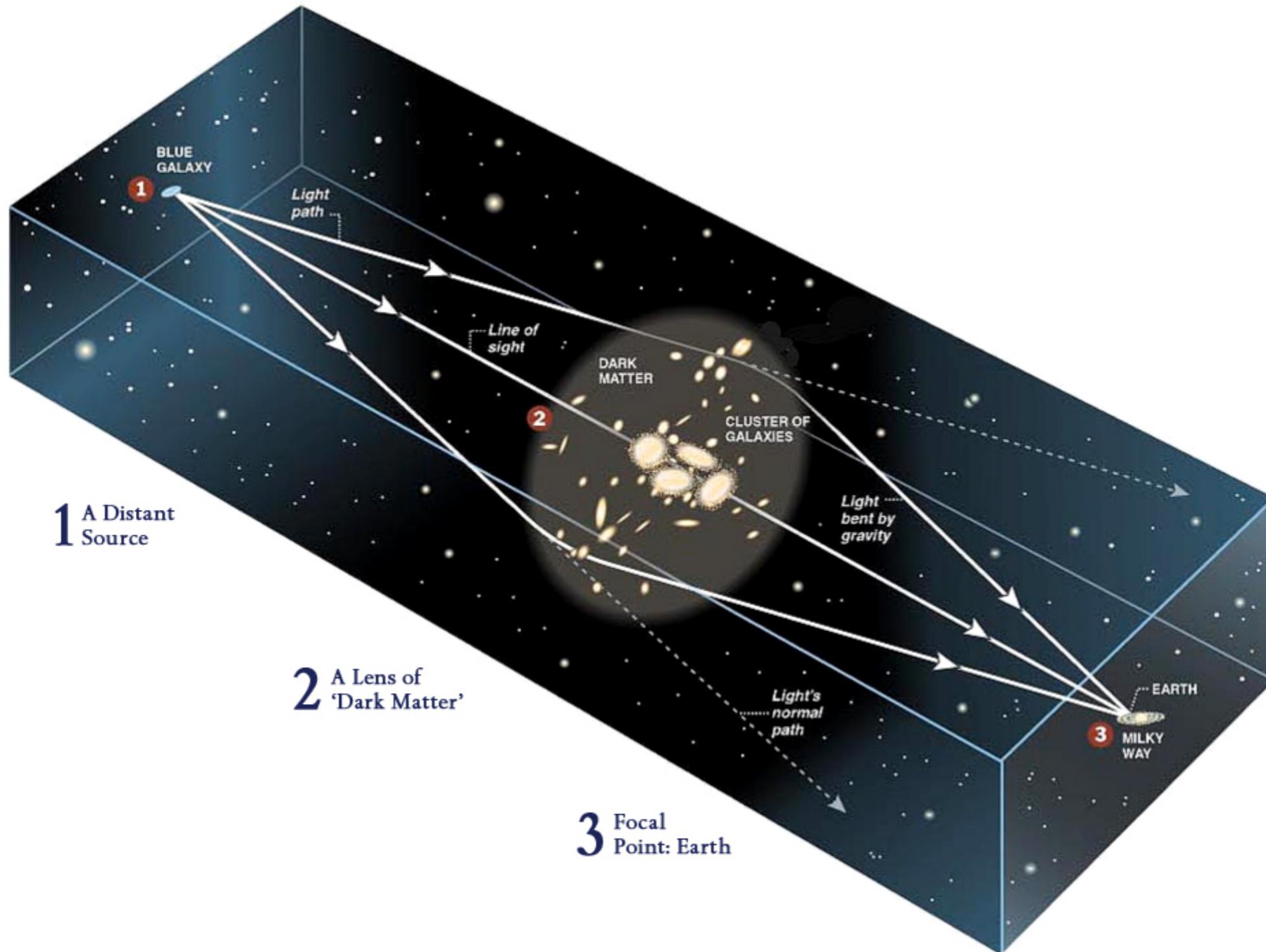
Cosmology



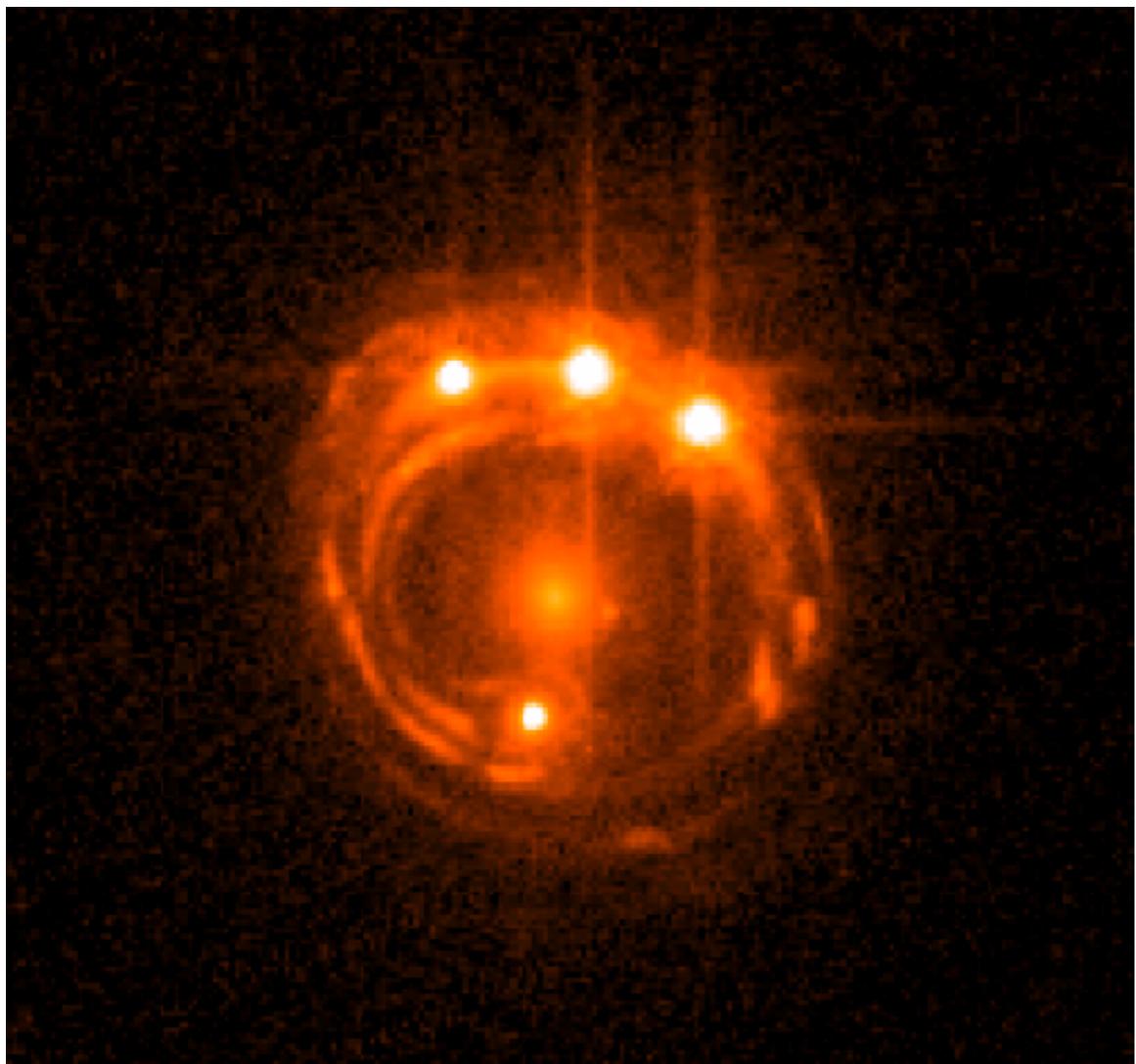
Cosmology



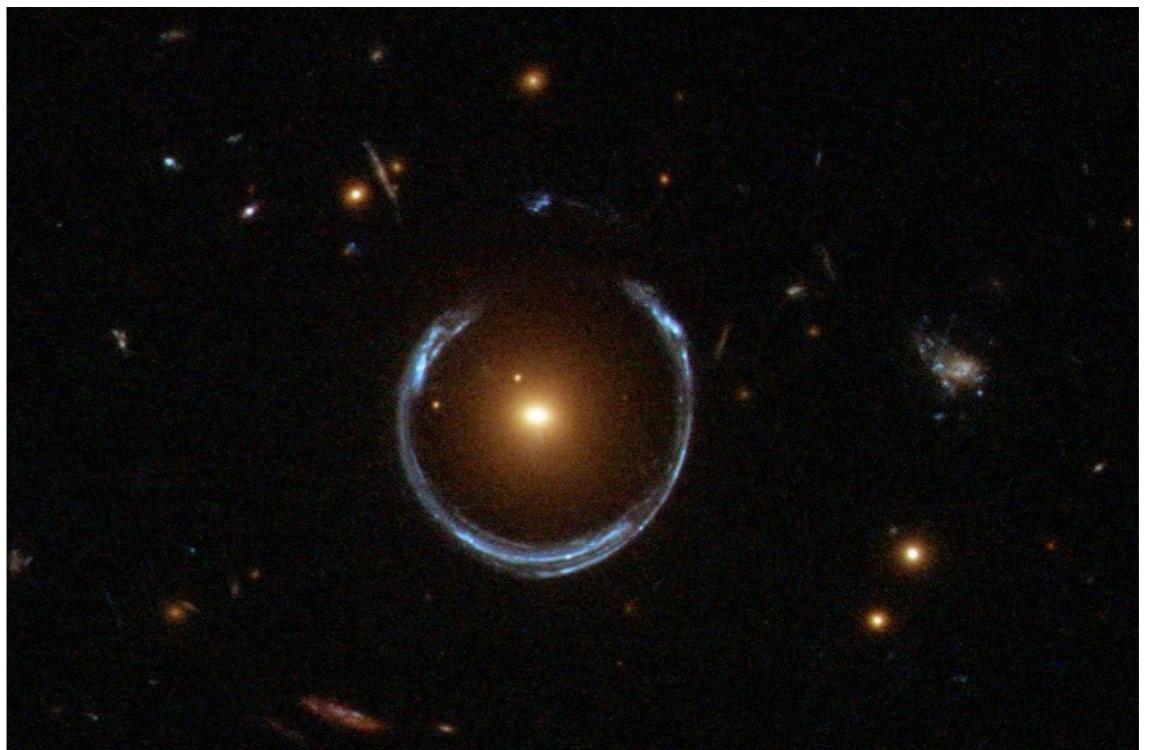
Gravitational Lensing



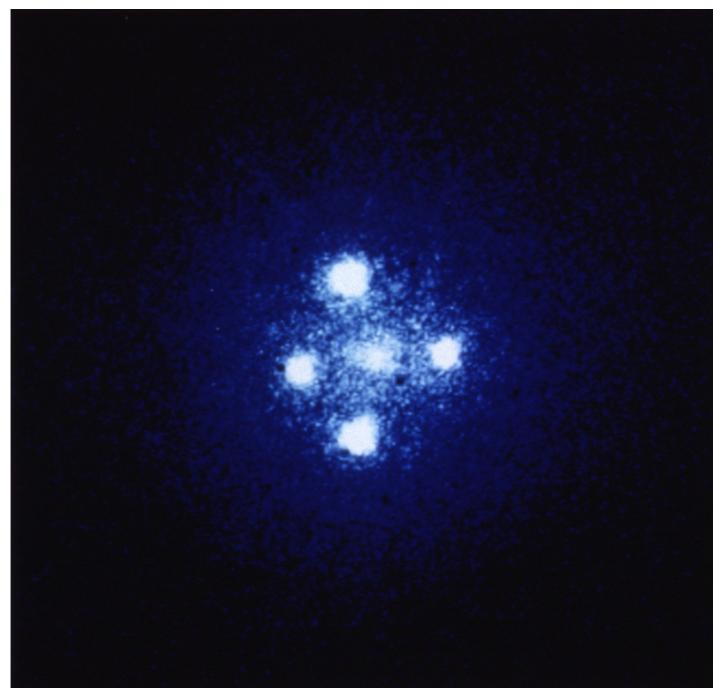
Gravitational Lensing



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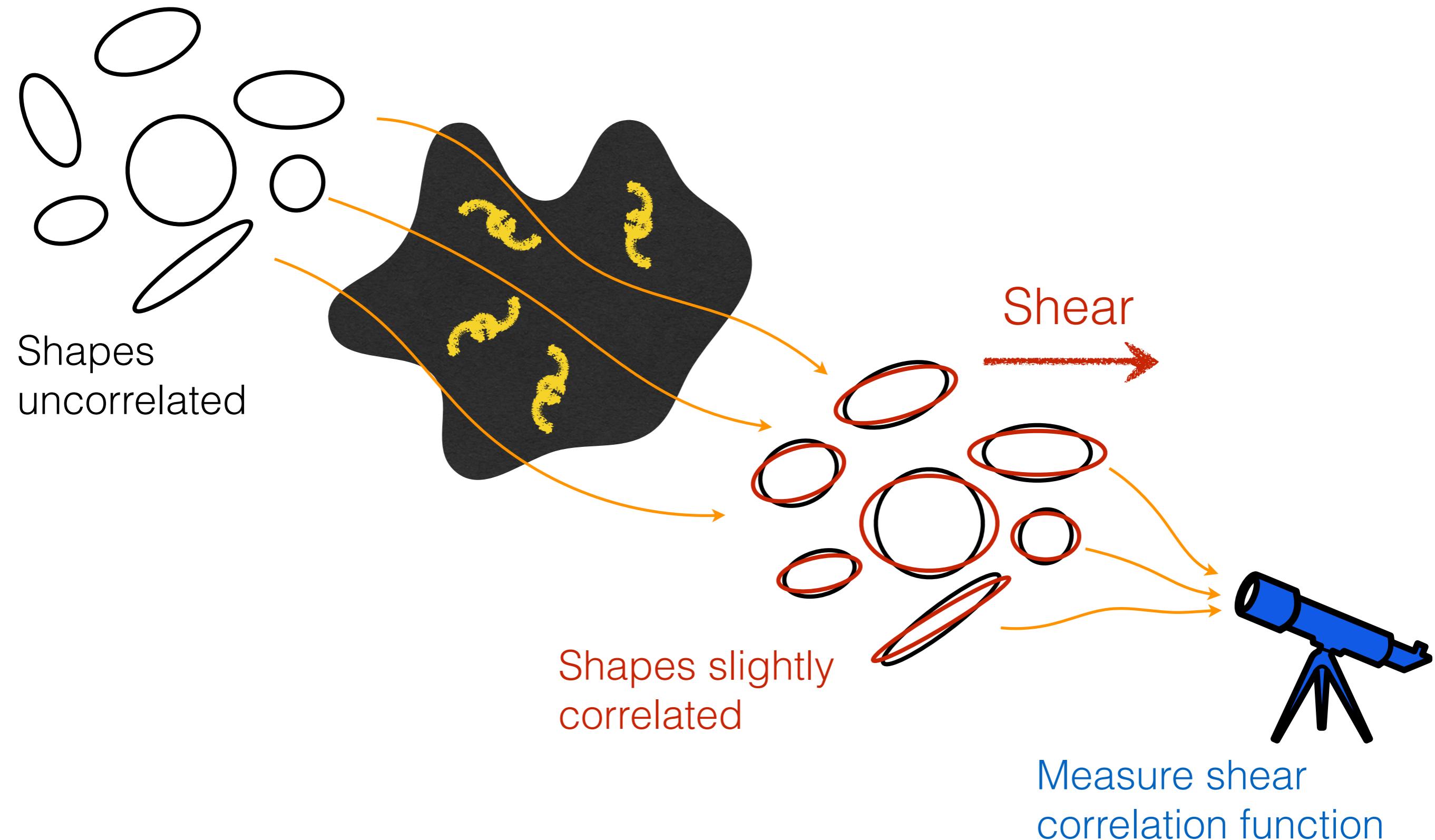


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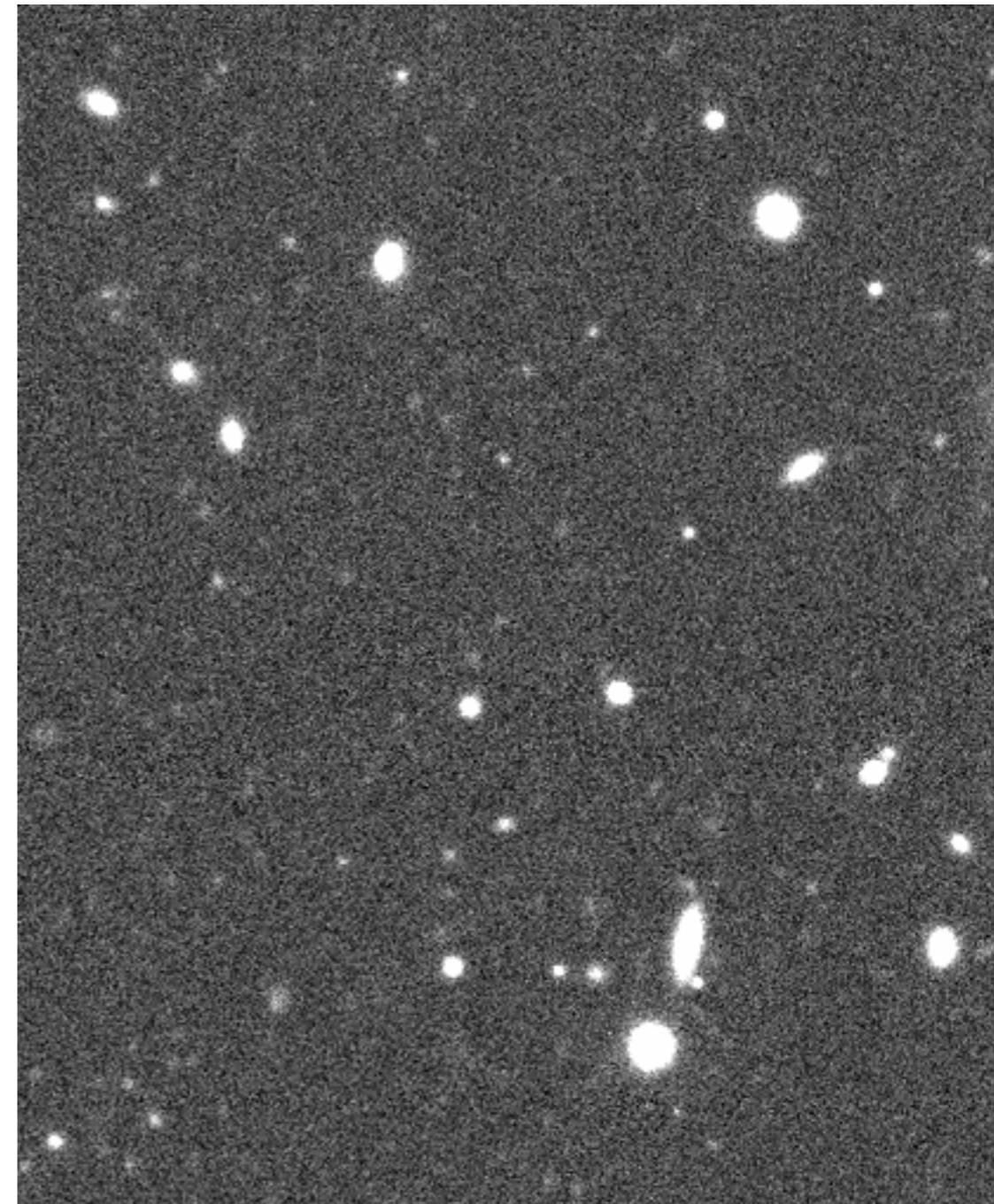
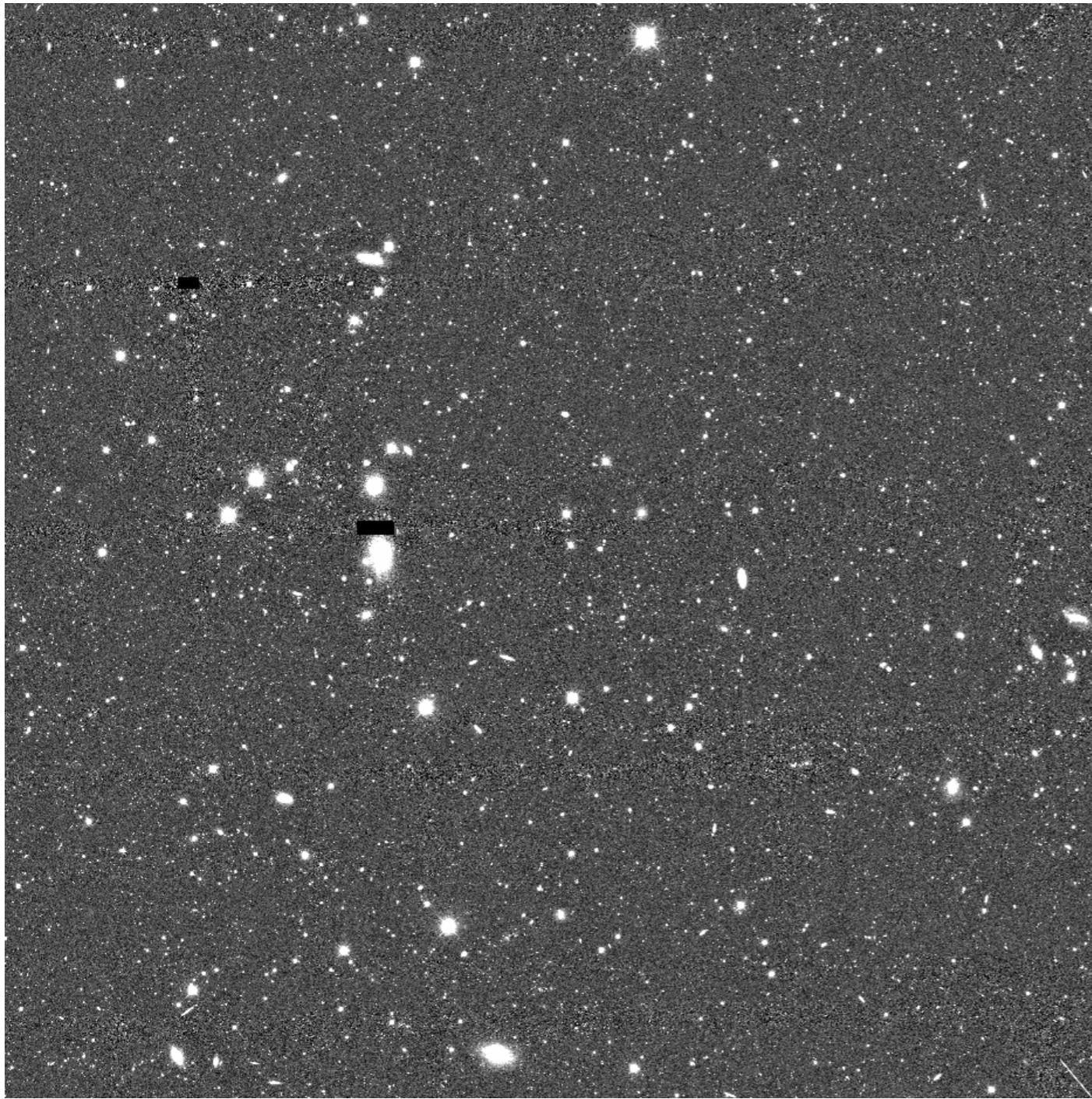


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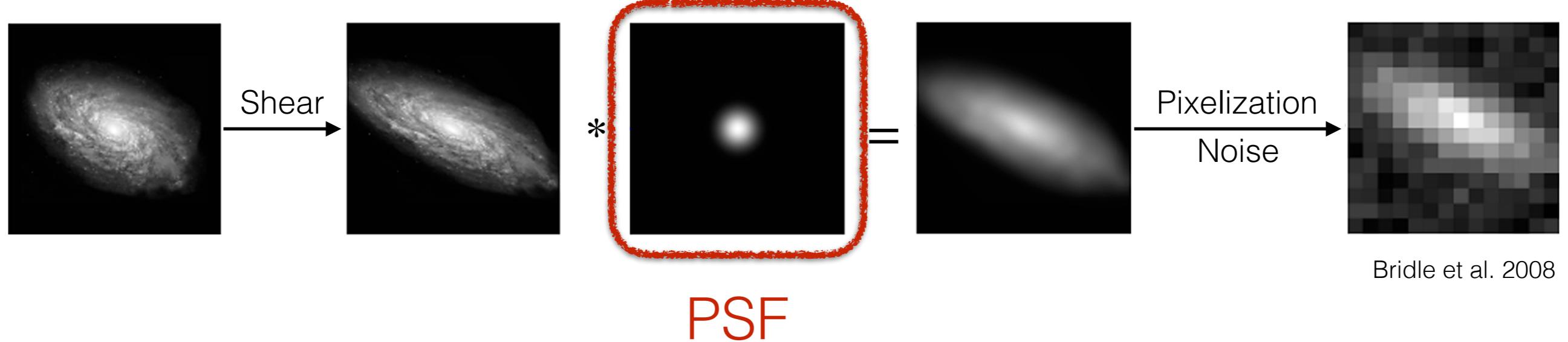
Weak Gravitational Lensing



Wide-field images

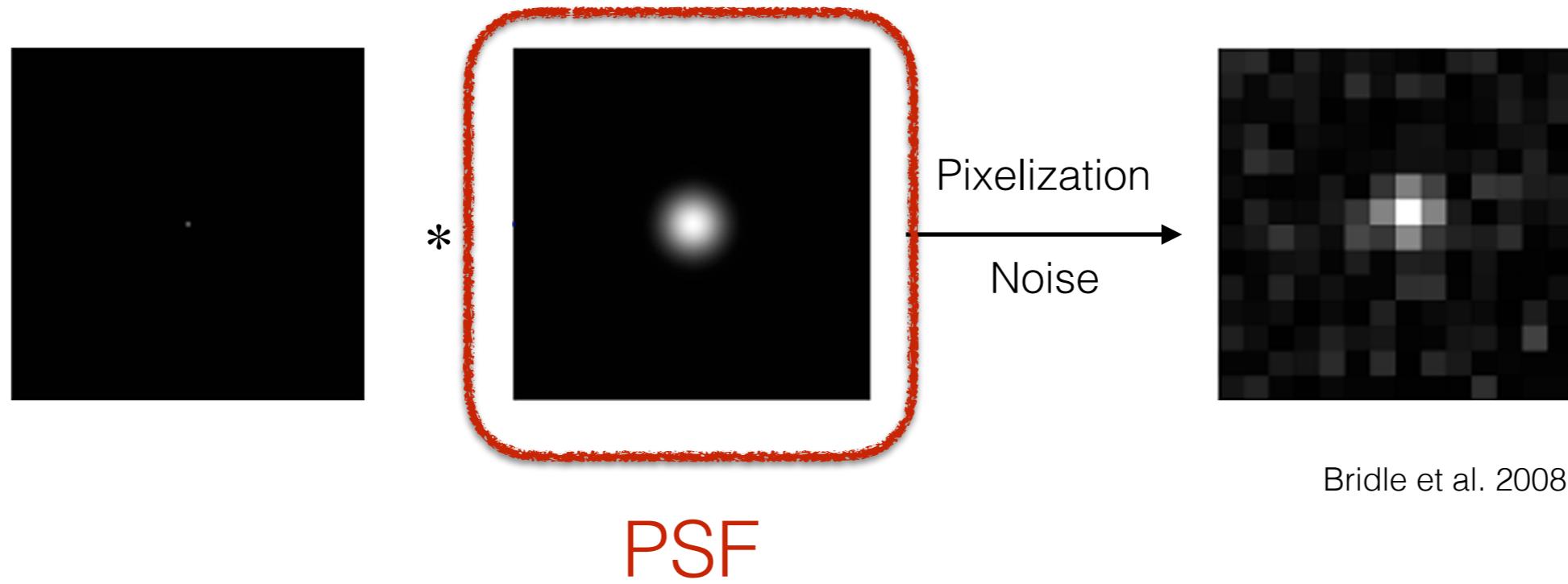


Point Spread Function



- The PSF distorts the image of any recorded object
- It needs to be modeled precisely when measuring cosmic shear
- It can be estimated directly from the data

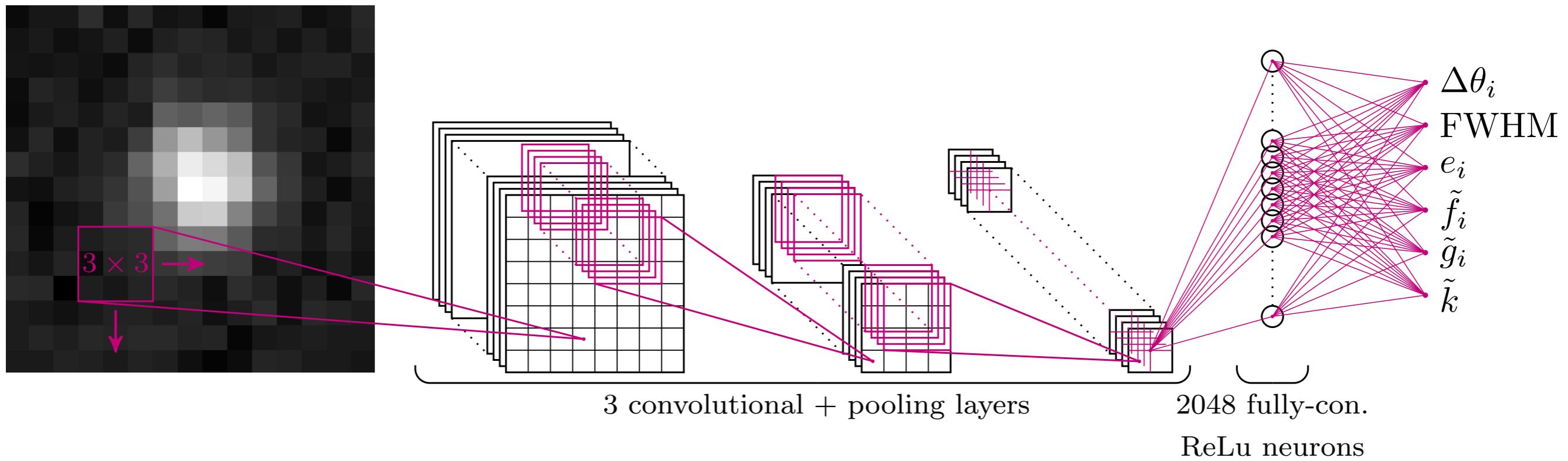
Point Spread Function



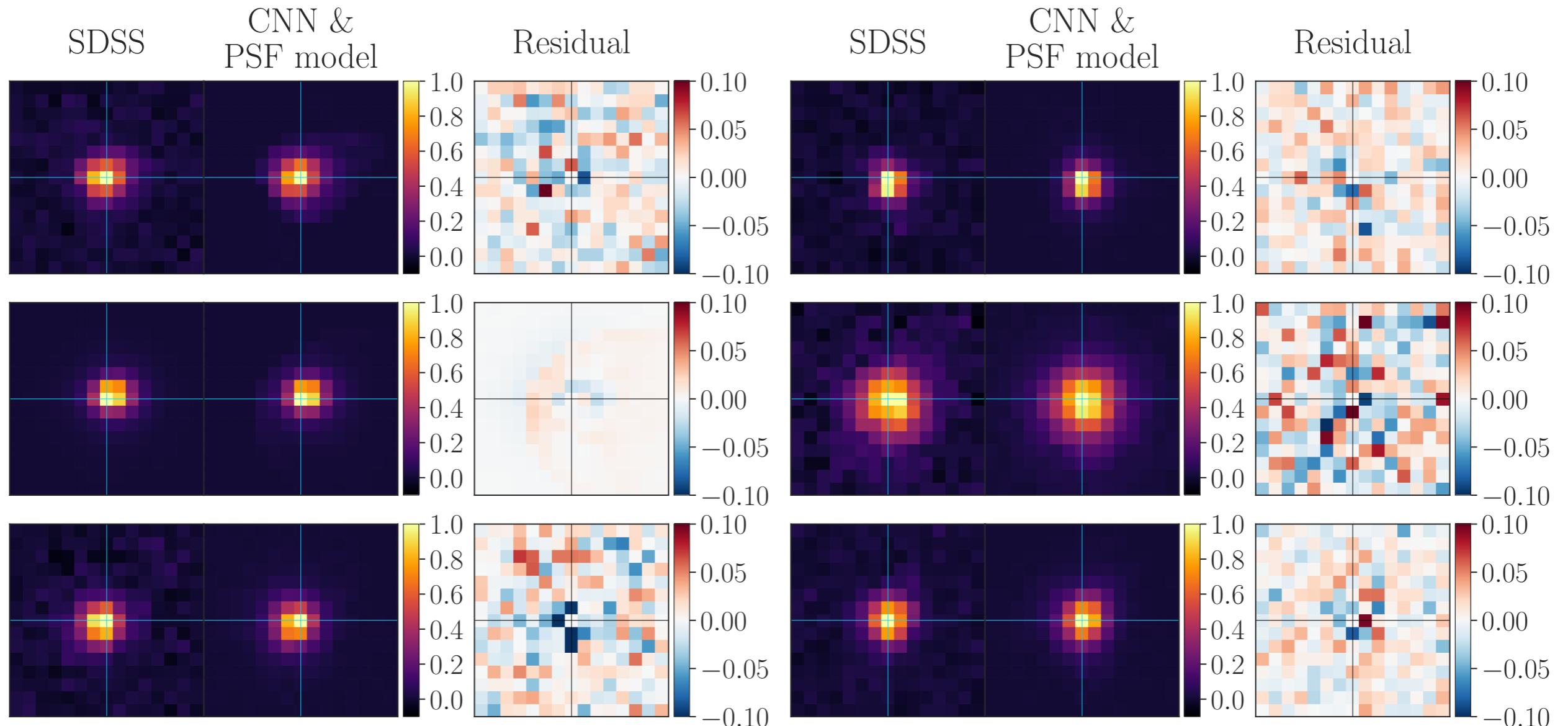
- Stars are point sources
- They are subject to the same PSF as galaxies
- They provide noisy samples of the PSF

PSF estimation with Deep Learning

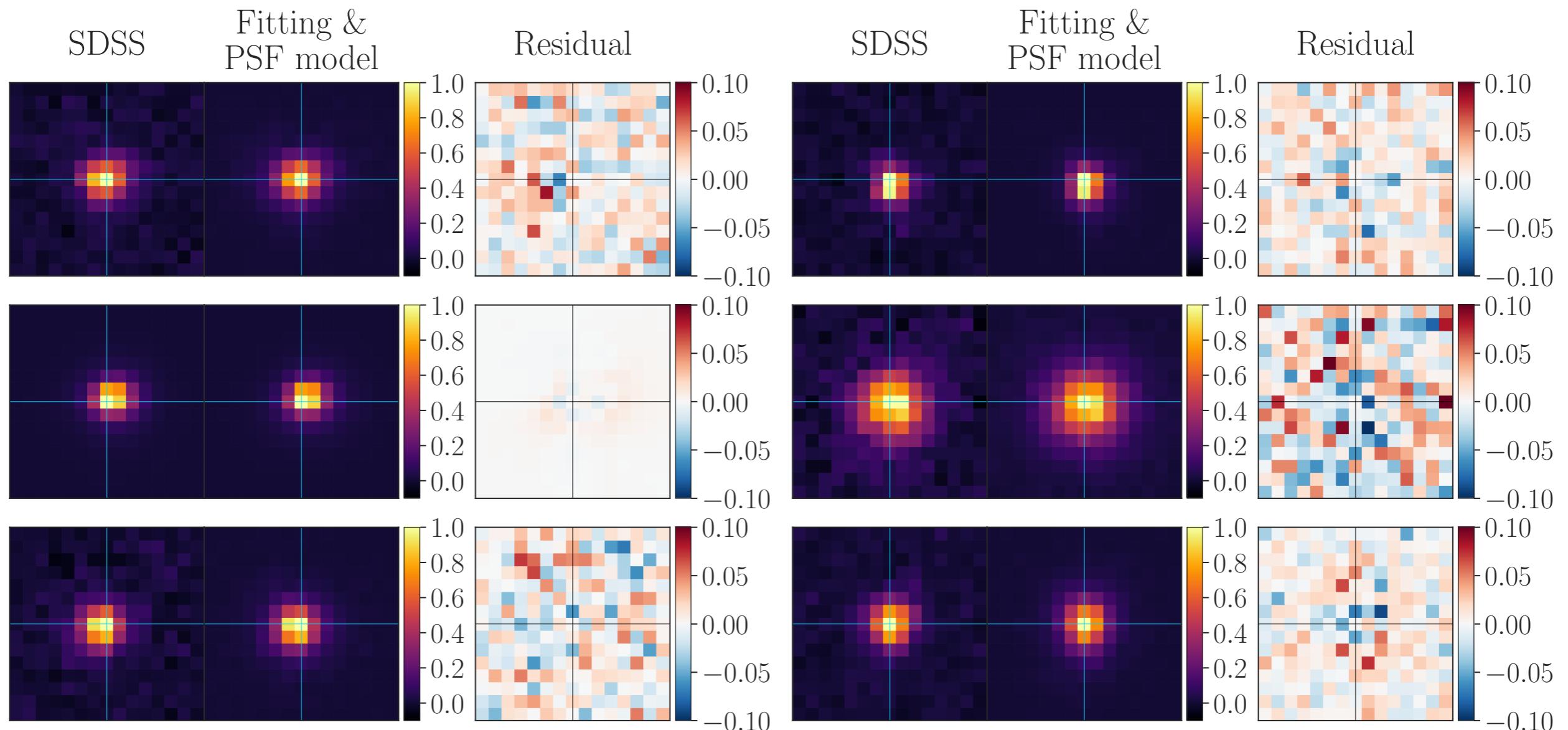
Task: Fit our PSF model to millions of stars



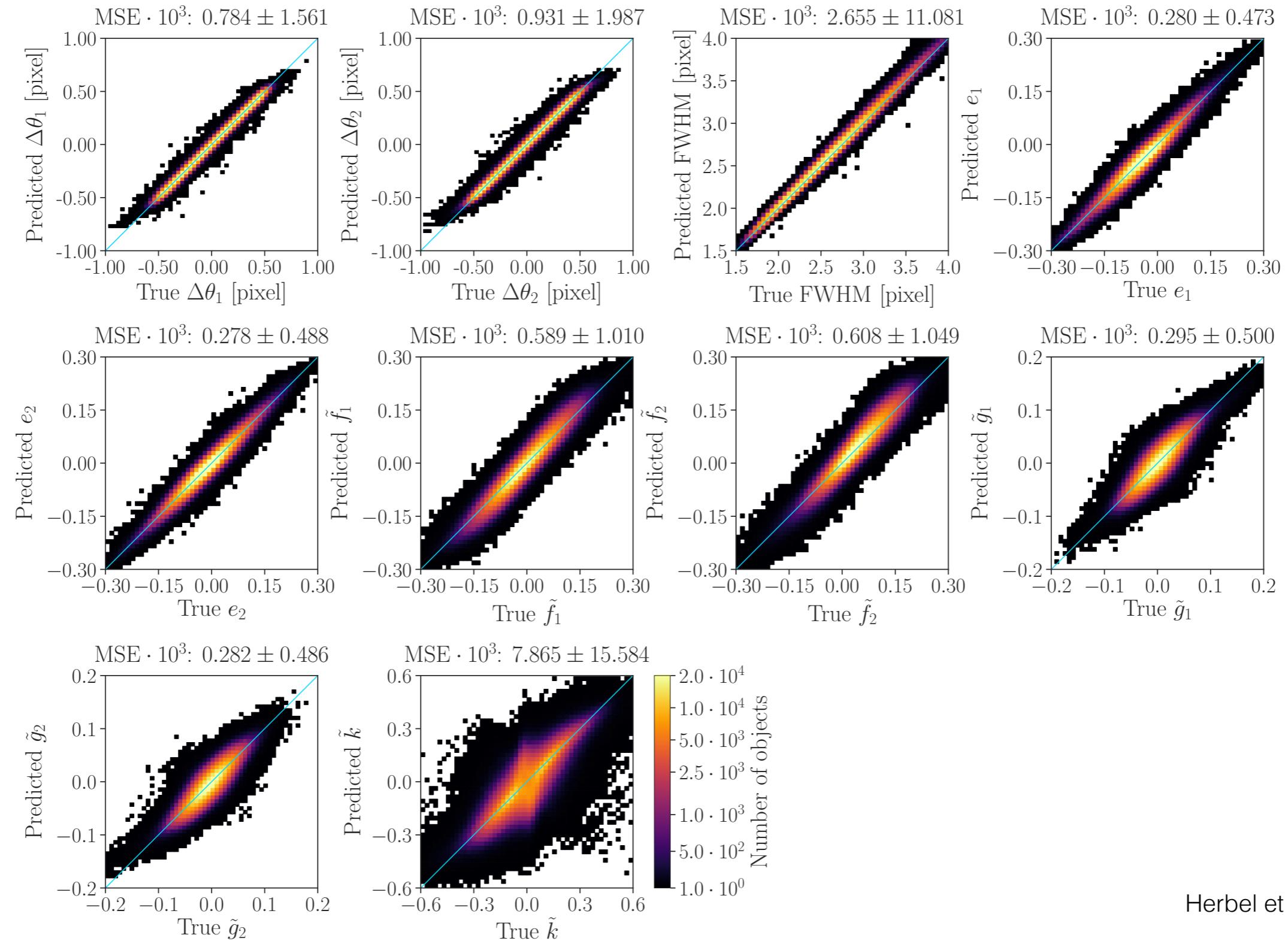
PSF estimation with Deep Learning



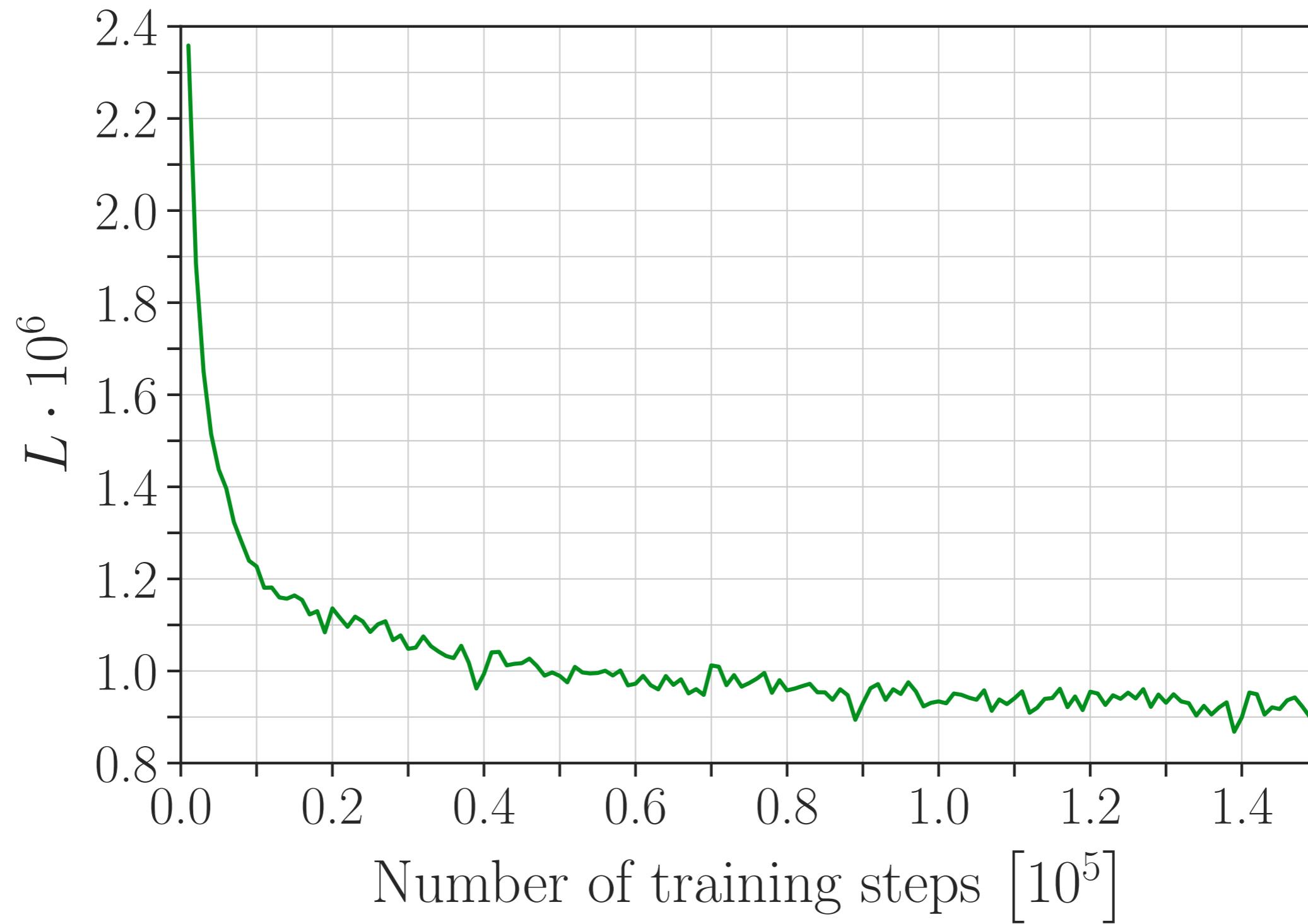
PSF estimation with direct fitting



PSF estimation with Deep Learning



PSF estimation with Deep Learning



Summary & Conclusions

- State-of-the-art cosmological surveys produce large data volumes
- Deep Learning can help to handle these data volumes
- Example: PSF estimation for cosmic shear measurements (thousands of stars per second)
- The data volume will continue to grow (LSST: tenths of TBs / night)