Weak Gravitational Lensing
Table Ronde: shear calibration

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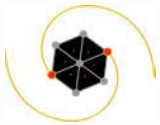
@energie_sombre #EuclidRoscoff2018

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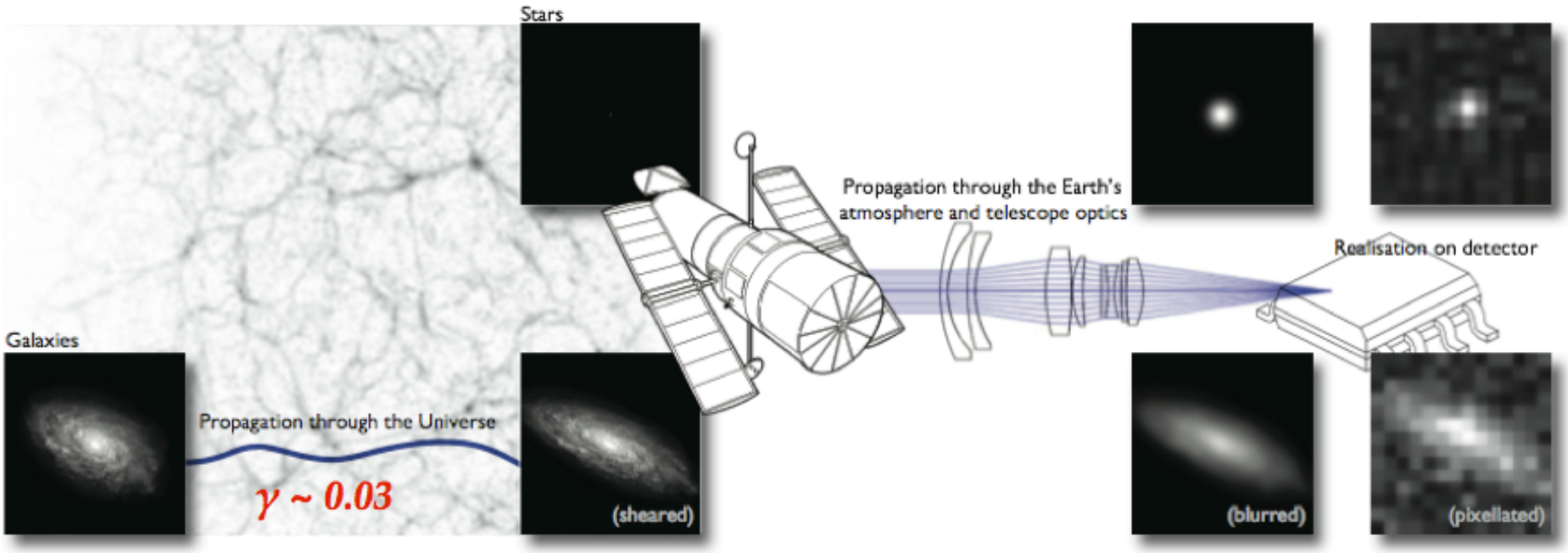
The shape measurement challenge



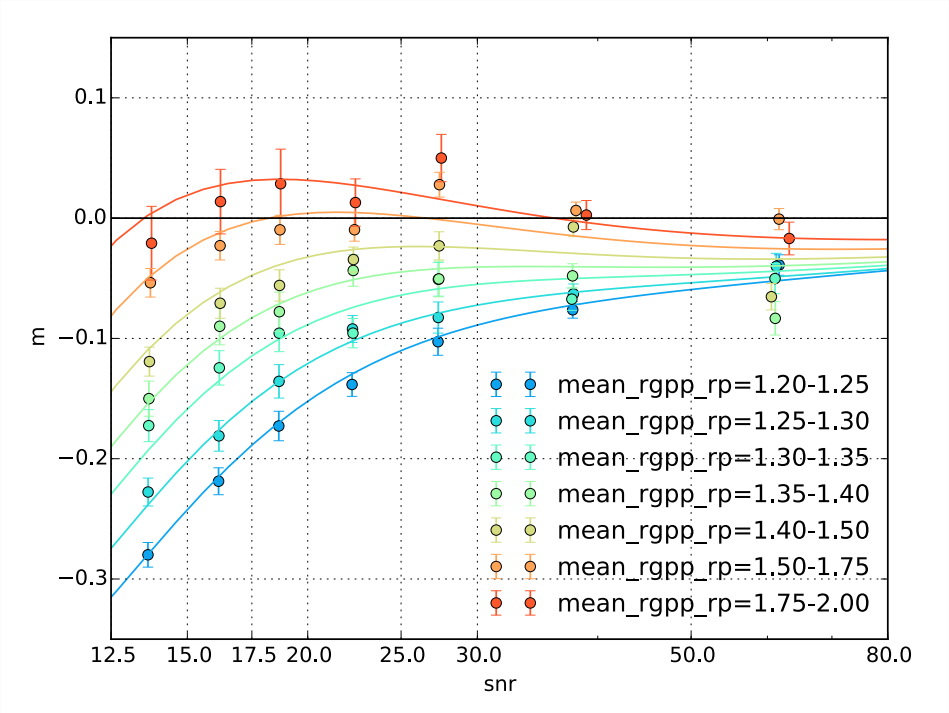
Bridle et al. 2008, great08 handbook

- LSS induces shall shear g (or γ) to images of high-z galaxies, $|g| \ll |\varepsilon|$ intrinsic ellipticity
- Beat down noise by averaging over many galaxies, $\langle \varepsilon \rangle = g$.
- Measured shapes are basically never unbiased. Write $\langle \varepsilon \rangle = g^{\rm obs} = (1+m) g^{\rm true} + c$

Shear calibration with image simulations

Done for most weak-lensing surveys:

- Simulate *a lot* of galaxy images with realistic properties, PSF, redshift distribution, ...
- Compute m and c as function of galaxy properties.
- Correct measured ellipticities.



DES, (Jarvis et al. 2016)

Euclid

Very high requirements on uncertainty of m and c, e.g. $|\Delta m| < 0.1\%$.

Necessary to get the few percent uncertainty on dark energy!

To achieve this accuracy, billions of galaxies need to be simulated (Hoekstra et al. 2017).

Recently, a new calibration method was developped, reducing the number of simulated galaxies by up to 3 orders of magnitude (Pujol et al. 2018).

Will be implemented in subsequent SGS science challenges and OU-SHE validation.

This allows us to study in much more detail

- bias as function of galaxy properties
- bias for individual galaxies
- blended galaxy images
- spatially varying bias
- bias from selection effects
- bias for simulated Euclid VIS images

Possible tasks for this table ronde

- Algebraic.
  - Explore transformation properties of bias (spin-2, spin-4 components, phases).
  - Examine high-order terms in ellipticity-shear relation, neglected in (Pujol et al. 2018).
- Numerical:
  - Spatially variable bias models, effect on shear statistics such as the shear power spectrum
  - Examine (individual) shear biases as function of (high-d) galaxy properties, use machine learning
  - Work with Euclid VIS simulations

Summary: working on shear calibration ...

- is super important for Euclid
- involves brand-new state-of-the-art method
- does not require large amount of expert knowledge

Tools

- GALSIM to simulate galaxy images.
- JUPYTER notebook implementing (Pujol et al. 2018) method. Arnau Pujol happy to be involved.
- ATHENA, PALLAS.PY, HEALPY to compute correlation functions and power spectra

Bibliography

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Hoekstra H, Viola M & Herbonnet R 2017 *MNRAS* **468**, 3295–3311.

Huff E & Mandelbaum R 2017 *arXiv* **1702.02600**.

Jarvis M, Sheldon E, Zuntz J, Kacprzak T, Bridle S L & al. 2016 *MNRAS* **460**, 2245–2281.

Pujol A, Kilbinger M, Sureau F & Bobin J 2018 *submitted to A&A, arXiv* **1806.10537**.

Tessore N & Bridle S 2018 *arXiv* **1807.06116**.

Other information

- `http://ntessore.github.io/notes/180624.html`