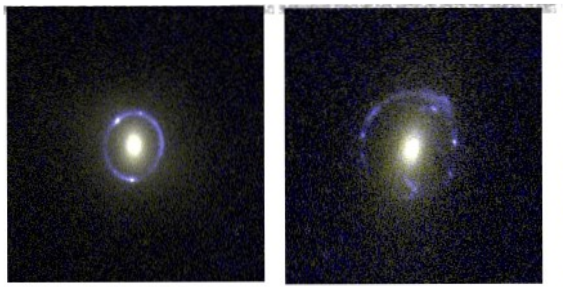
IPhU / Dark Matter meeting

The small-scale dark matter content in galaxies and clusters of galaxies from weak and strong lensing

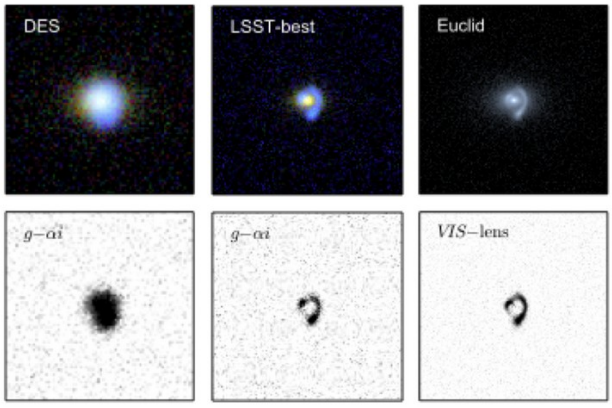


Raphael Gavazzi
LAM / IAP

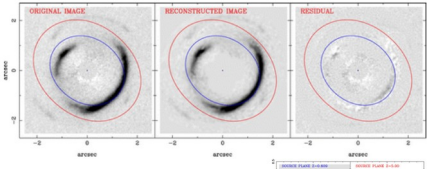
Research interests

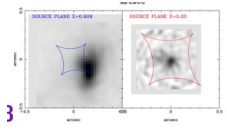
- Combination of strong and weak lensing in the core of galaxies and galaxy clusters
- Worked at IAP until 2020, then spent 1 year at IoA, Cambridge. Since Sept 2021, at LAM !
- Active in Euclid (co-lead of SL-SWG), recently joined LSST/Rubin for SL/WL
- Ray-tracing in hydro-dynamical cosmo sims
- WL cluster mass profiles in the AMALGAM/CHEX-MATE cluster sample

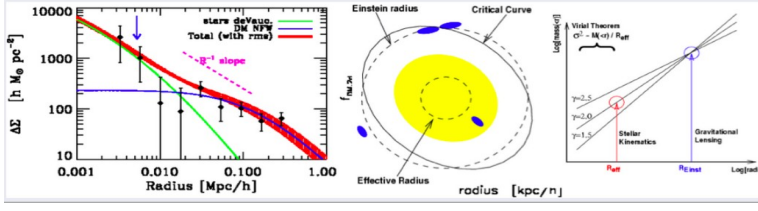
Lensing by massive galaxies



- Finding them
  - Optical SLACS (spectro+HST) / SL2S (imaging+HST) /
  - Submm/FIR (Herschel/SPT... → ALMA/NOEMA interferometry)
  - Upcoming: Euclid & LSST
- Modeling them

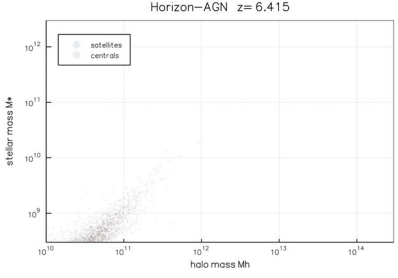






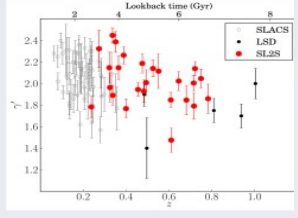
- Comparison w/ hydro-dynamical cosmo sims

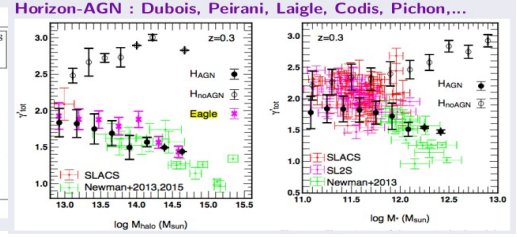
$$p(M_{\rm h}, \cdots | M_*, \cdots)$$



$$\gamma' = \frac{{\rm d}\log\rho_{\rm tot}}{{\rm d}\log r} \sim 2.08 \pm 0.02$$

Dispersion $\sigma_{\gamma'} = 0.12 \pm 0.02$

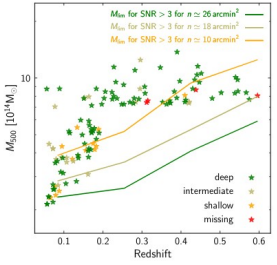


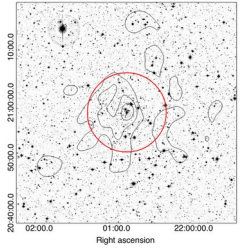


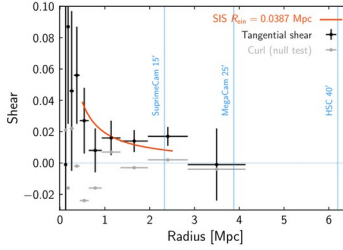
Cluster mass estimates AMALGAM & CHEX-MATE

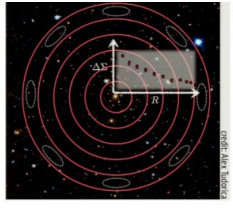
Stands for "Ajustement de Modèles Appliqué aux Lentilles Gravitationnelles dans les AMas de galaxies",

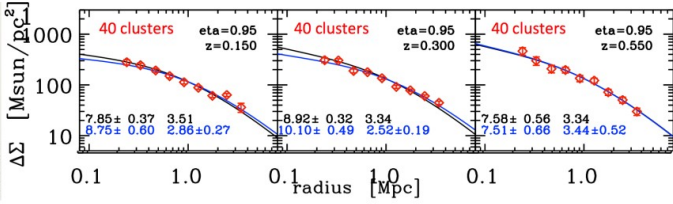
- ~200 clusters in CFHT/Subaru archives
- Sample based on Planck $M_{500,SZ}$ (CHEX-MATE *arXiv:2010.11972*)
- Methodological dev for shape and redshift estimations
- If lensing mass is accurate to 20-40 %, should enable a 4% calibration of mass proxies







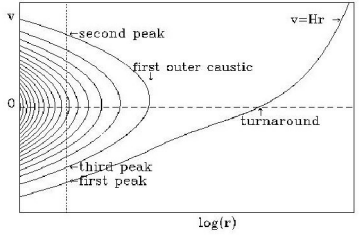


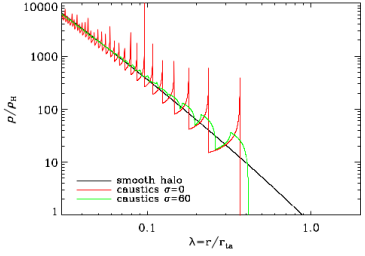


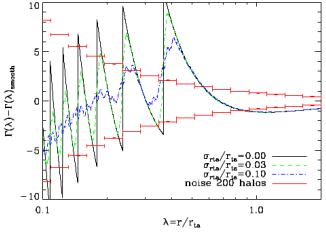
- Substructure (cluster member galaxies): tidal stripping

- Inner mass distribution cusp/core with SL + stellar kinematics

- Detection of DM caustics with WL (*Gavazzi+06*) -> 'splashback' radius

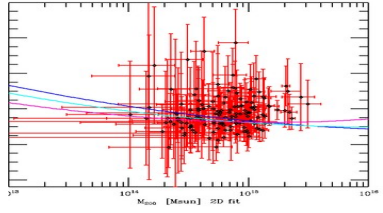




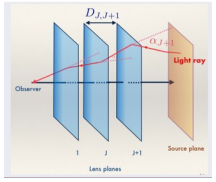


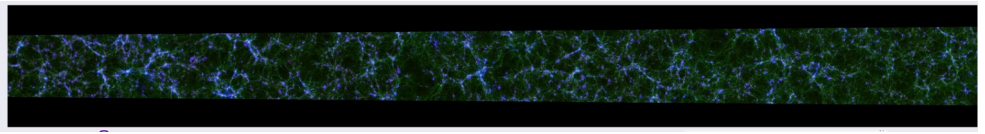
NFW fit on individual clusters in the range 0.5-2 Mpc

Concentration-mass relation
Looks consistent with Klypin++16



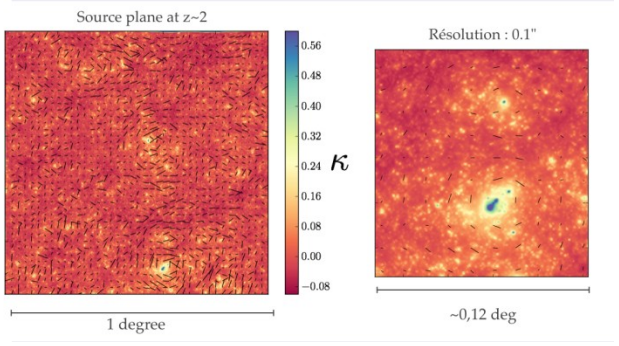
Ray tracing (in Horizon-AGN)

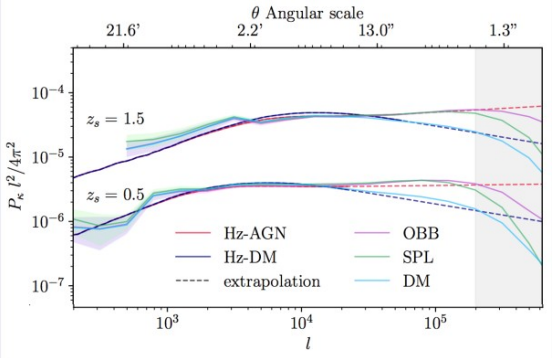




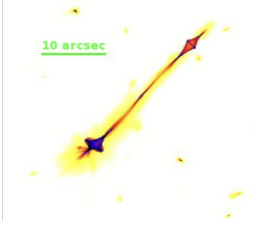
(PhD C Gouin + Y Dubois + IAP colleagues)

Statistics of shear and convergence fields





M*~3.3e11, zl=0.88, zs=2.33, With a rate of ~20 real events per deg^2, H-AGN a bit small.



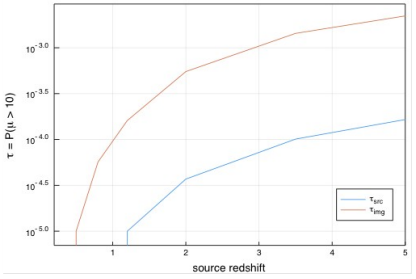
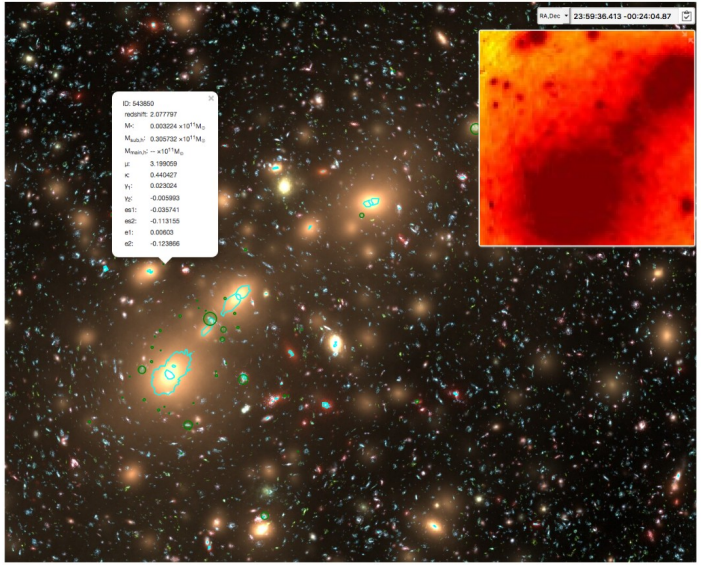


Image simulations



http://amalgam2.iap.fr/Horizon-AGN/show.html?center=23:59:59.840%20-00:12:56.95&fov=0.04196

Questions?


THAT CONCLUDES MY TWO-HOUR PRESENTATION. ANY QUESTIONS?
DID YOU INTEND THE PRESENTATION TO BE INCOMPREHENSIBLE, OR DO YOU HAVE SOME SORT OF RARE "POWERPOINT" DISABILITY?
ARE THERE ANY QUESTIONS ABOUT THE CONTENT?
THERE WAS CONTENT?
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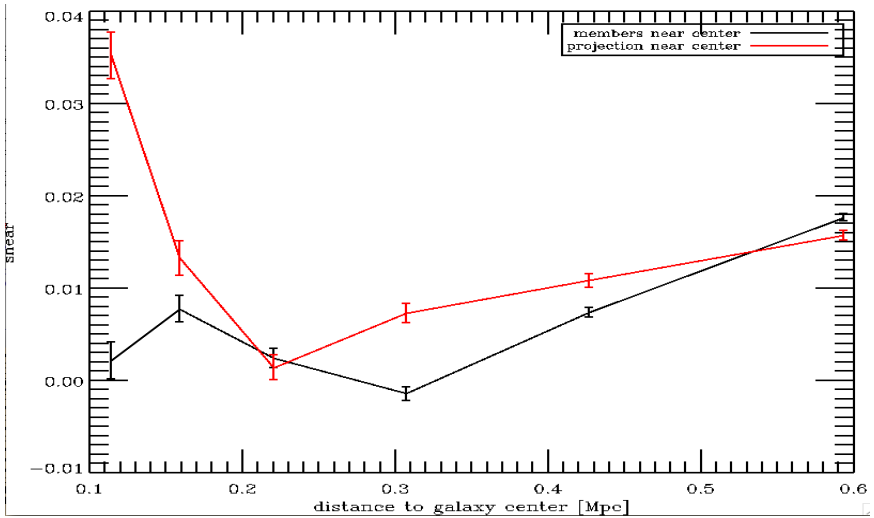
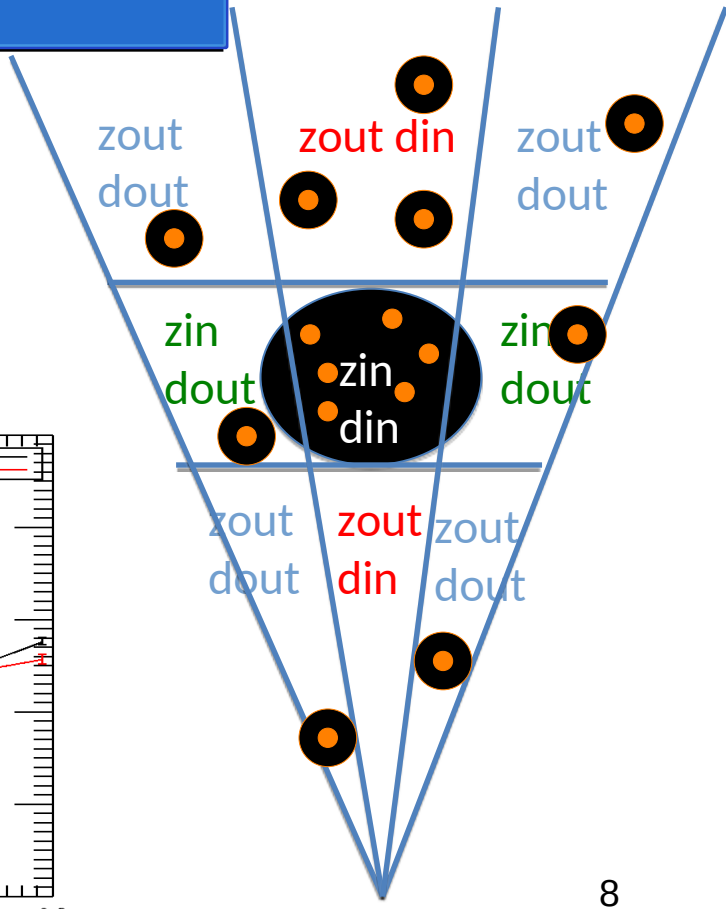
EXTRA MATERIAL

Shear around truncated sub-halos

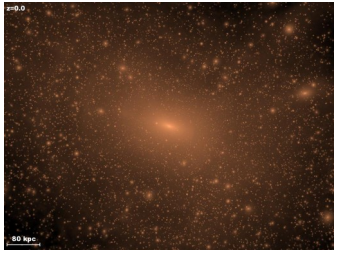
- Preliminary results by internship student (J Christiano)
- SDSS spectro (1e4 lenses w/ z and 150<σ<300 km/s)
- AMALGAM (9e5 sources)
- At same σ (or M_*), cluster member galaxies have lost ~80% of their mass

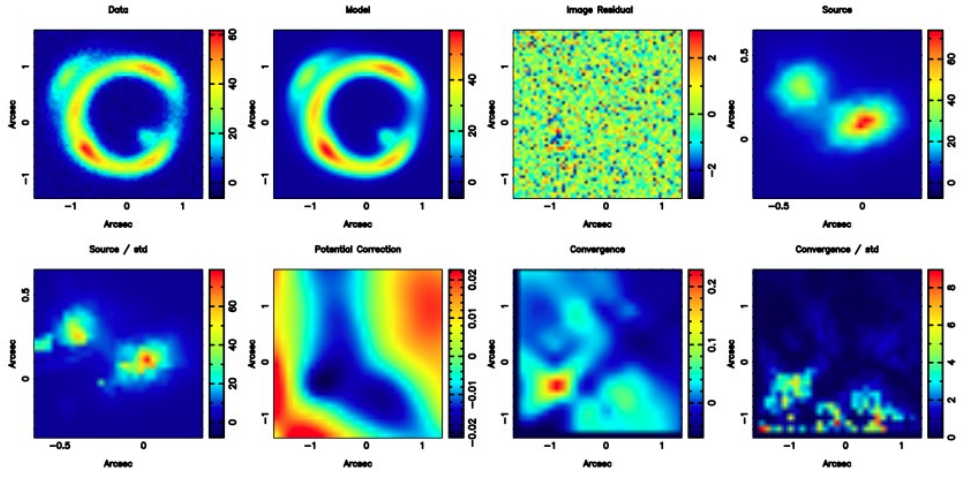




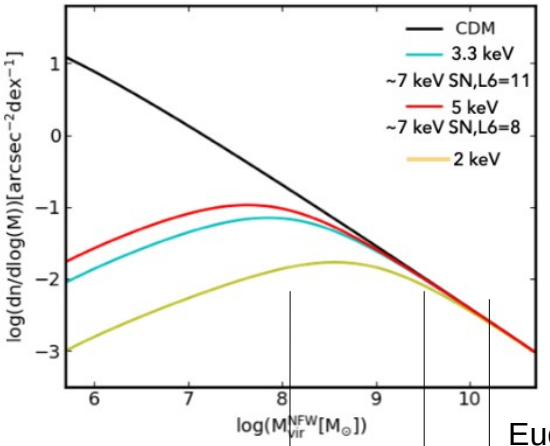
See also Niemiec et al 17

Substructure with SL





Vegetti++



Euclid wide

Euclid deep (3000 x HST-like lenses)

ELT follow-up of Euclid lenses

Statistical / individual detections of clumps difficult,
Line of sight perturbation tricky

Mock images

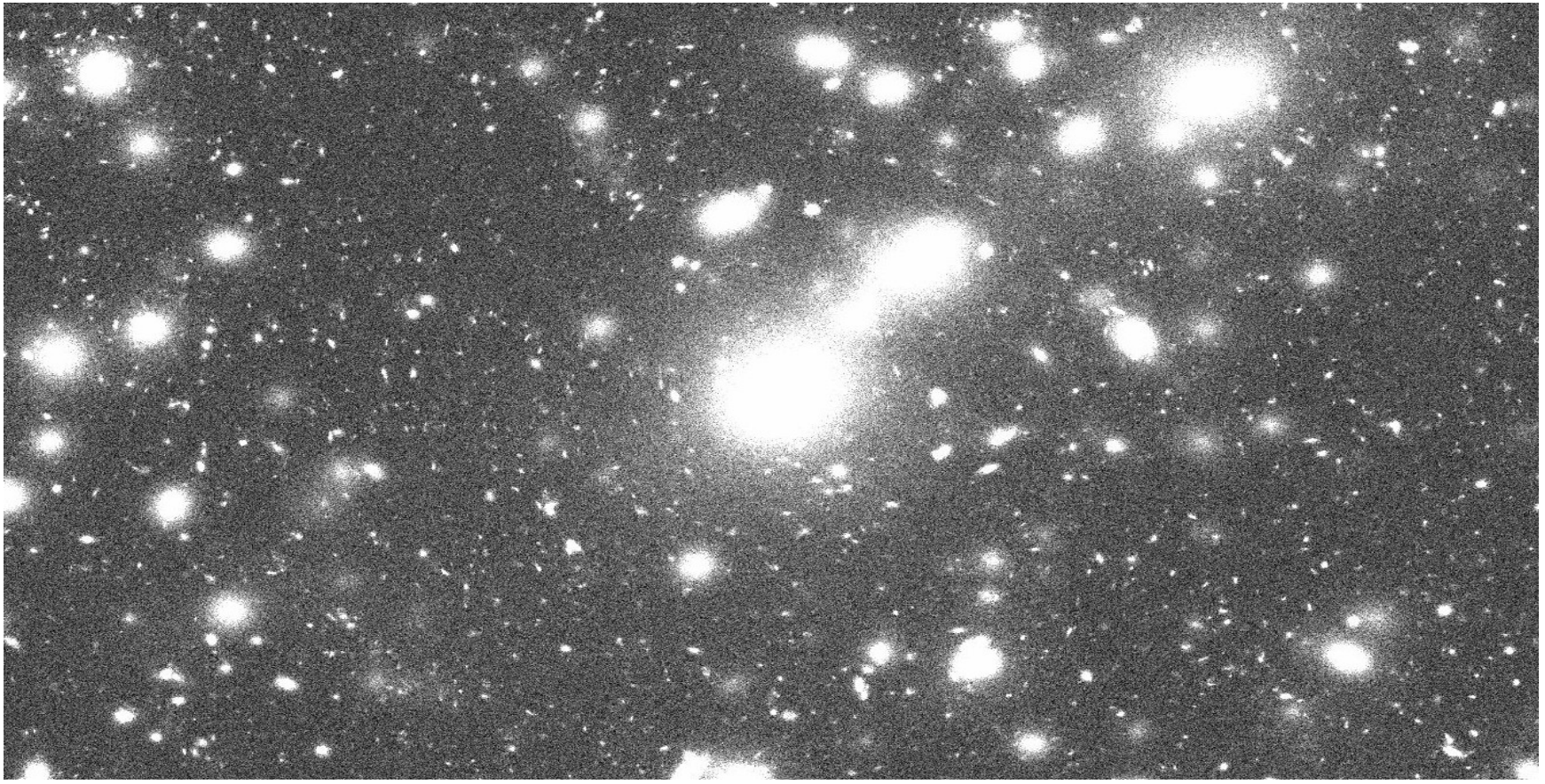
No Lensing

Mock images

Lensing

Mock images

Lensing



+
Euclid Wide
Instrumental
effects

(EXT and NIR
bands
ongoing...)