Fast and reliable dark matter inference for Euclid strong lenses

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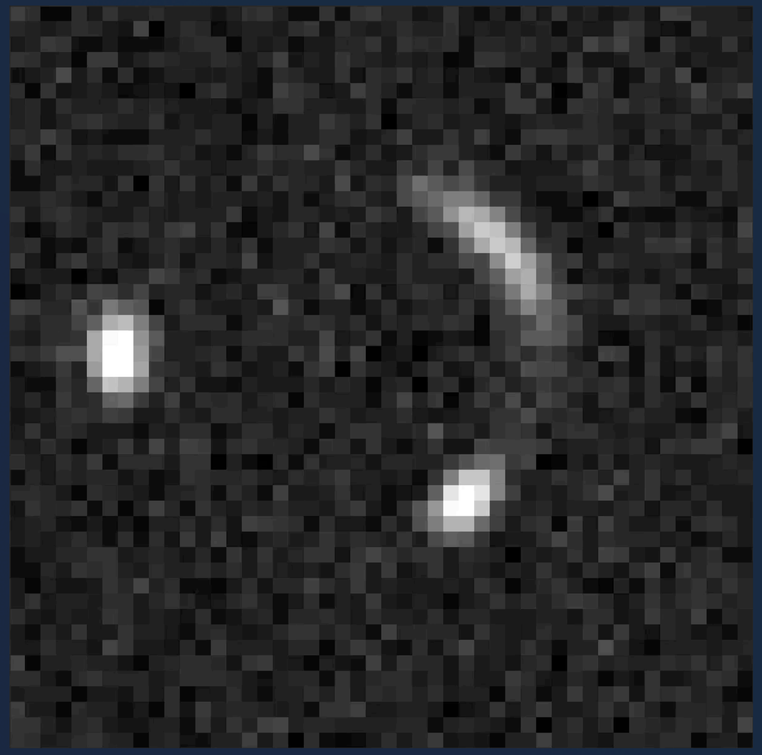
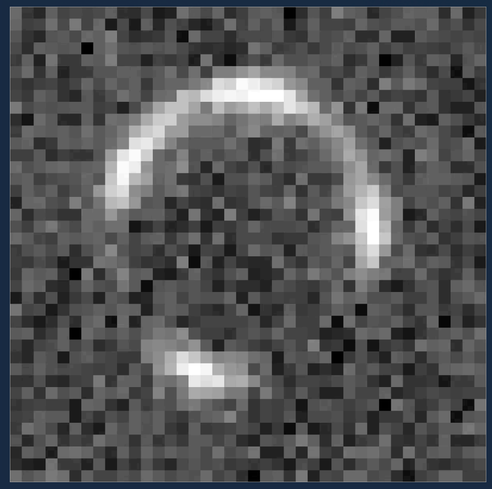
Training data



ResNet-50

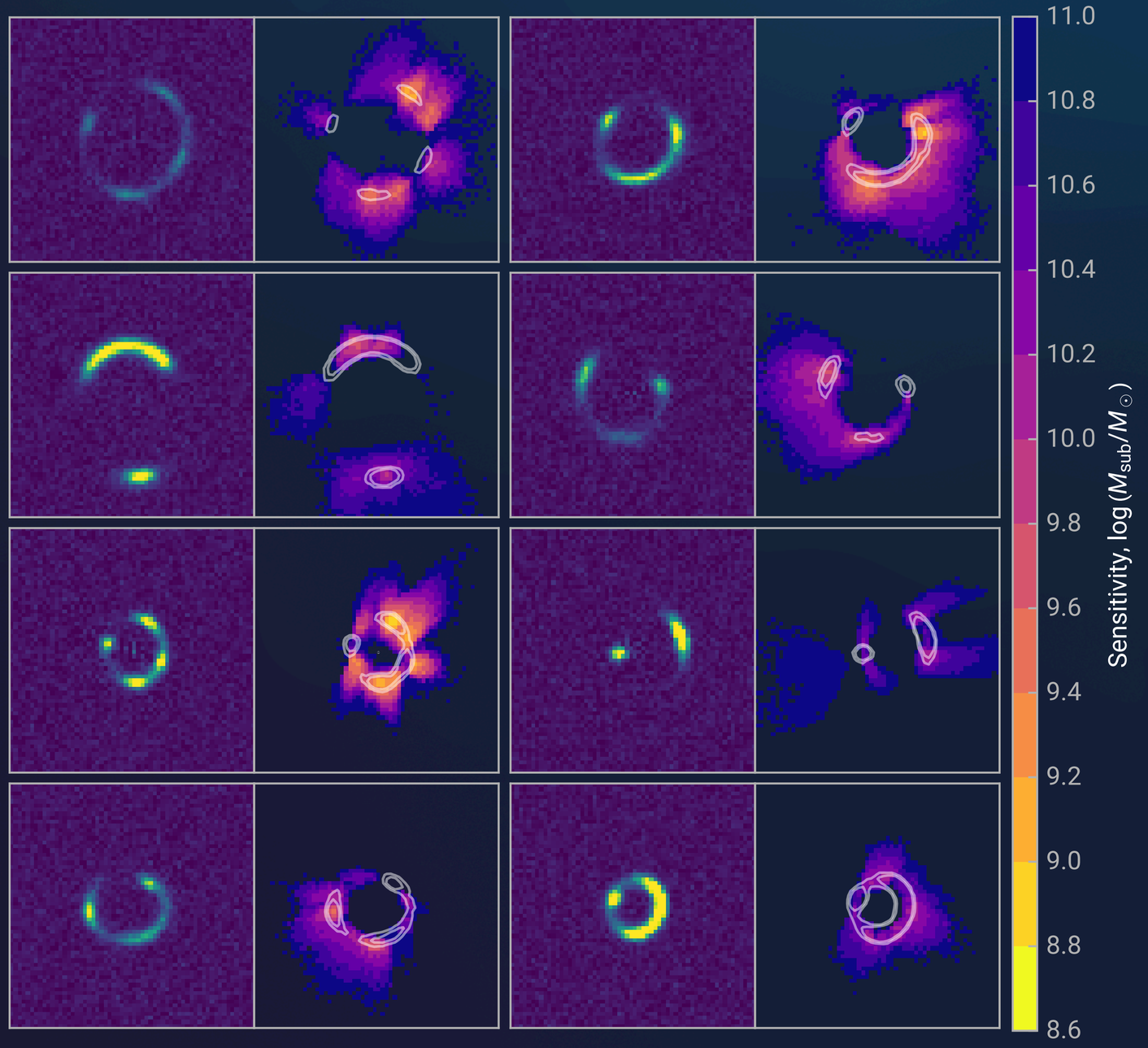
Sensitivity images



$\mathrm{P}(\mathrm{sub}\,|\,d)$

Sensitivity map

Smallest detectable mass in every pixel



Predictions for *Euclid*

1 in 70
lenses yield a detection

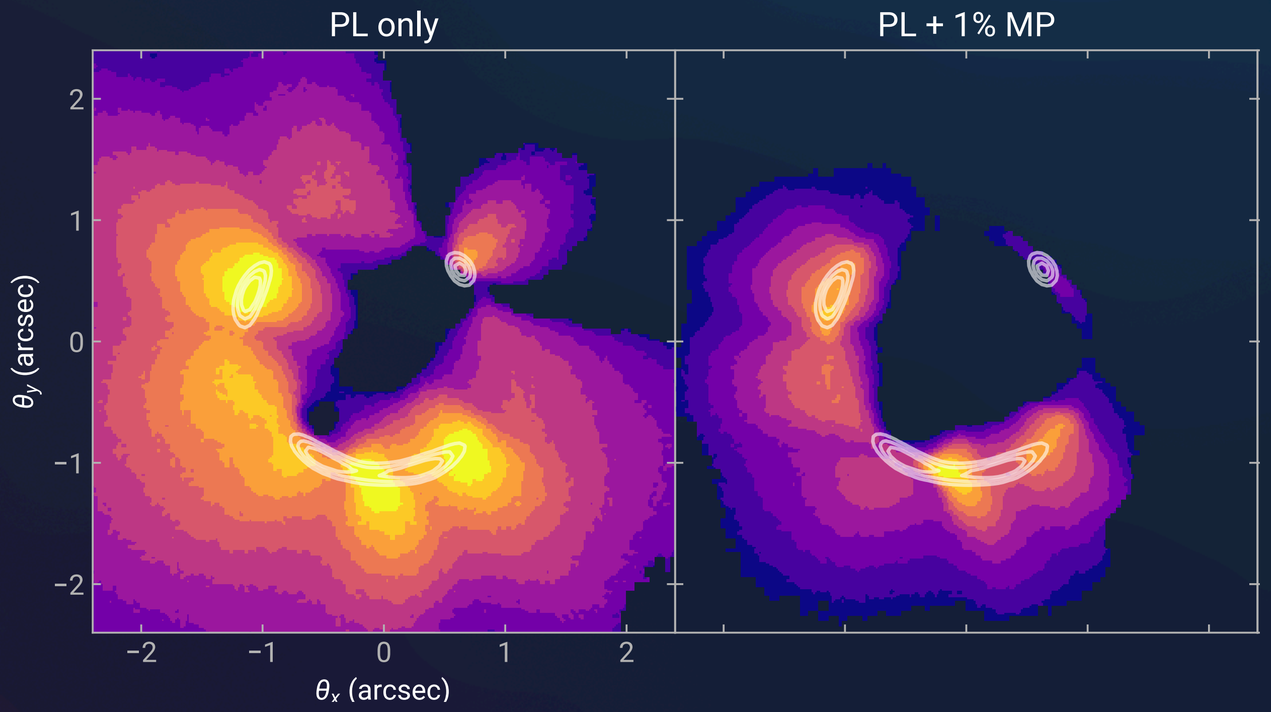
1 in 3
in the best lenses

2500
new subhalo detections

$10^{8.8}\,M_\odot$
smallest detectable object*

*real *Euclid* lenses agree

Testing systematics



Allowing for 1% angular perturbations in the lens means…

80%

loss in sensitive area

0.25 dex

loss in sensitivity depth

Dark matter science in *Euclid*

Now: *the first 100s of lenses*

- First dark substructure detections
- Measuring multipoles in large lens sample
- 100s of non-detections would be in tension with CDM

Soon: *the first 1000 lenses and beyond*

- First constraints on $f_{\rm sub}$
- Constraints on LOS mass function
- ML sensitivity mapping at large scales