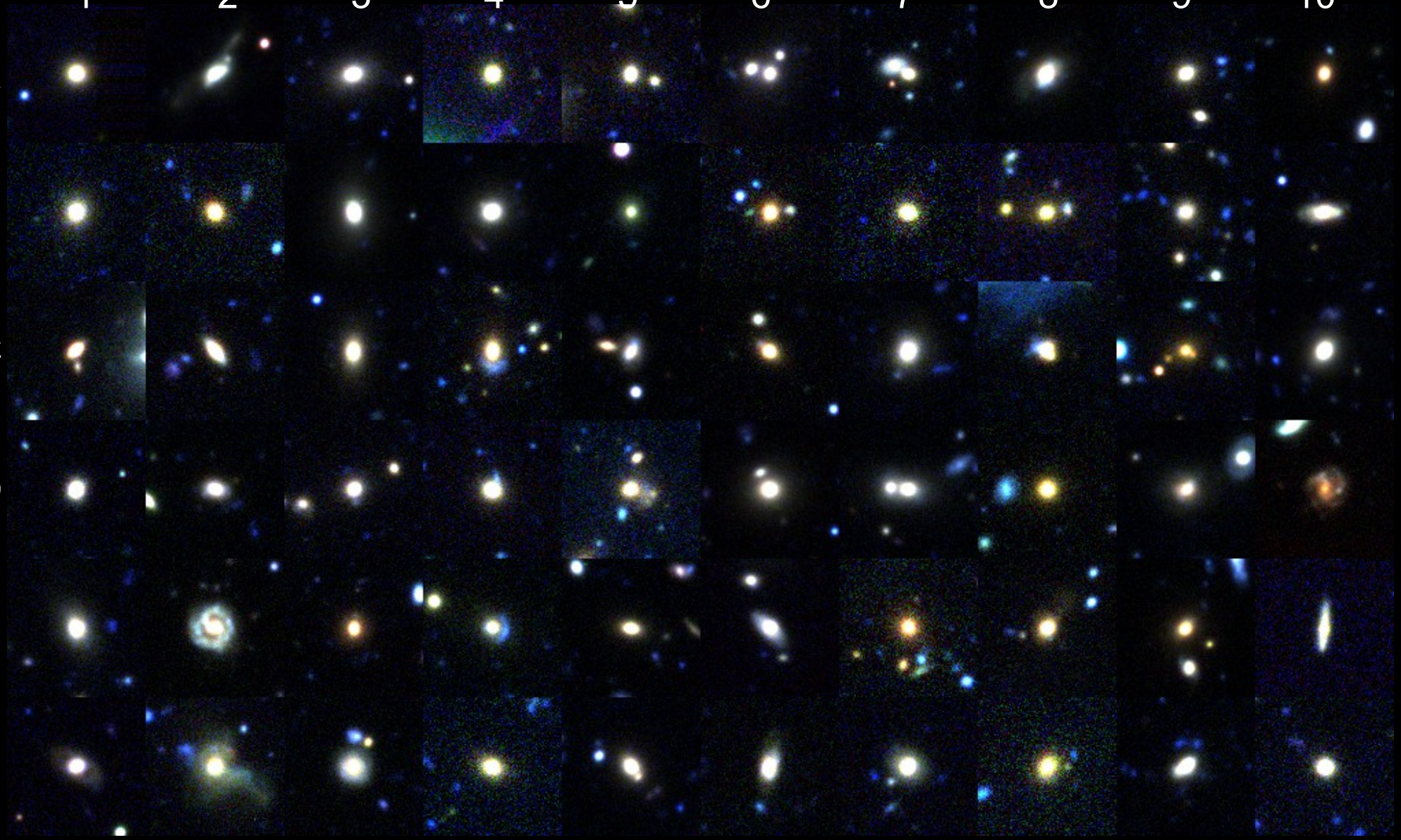
Automatic search for strong lenses

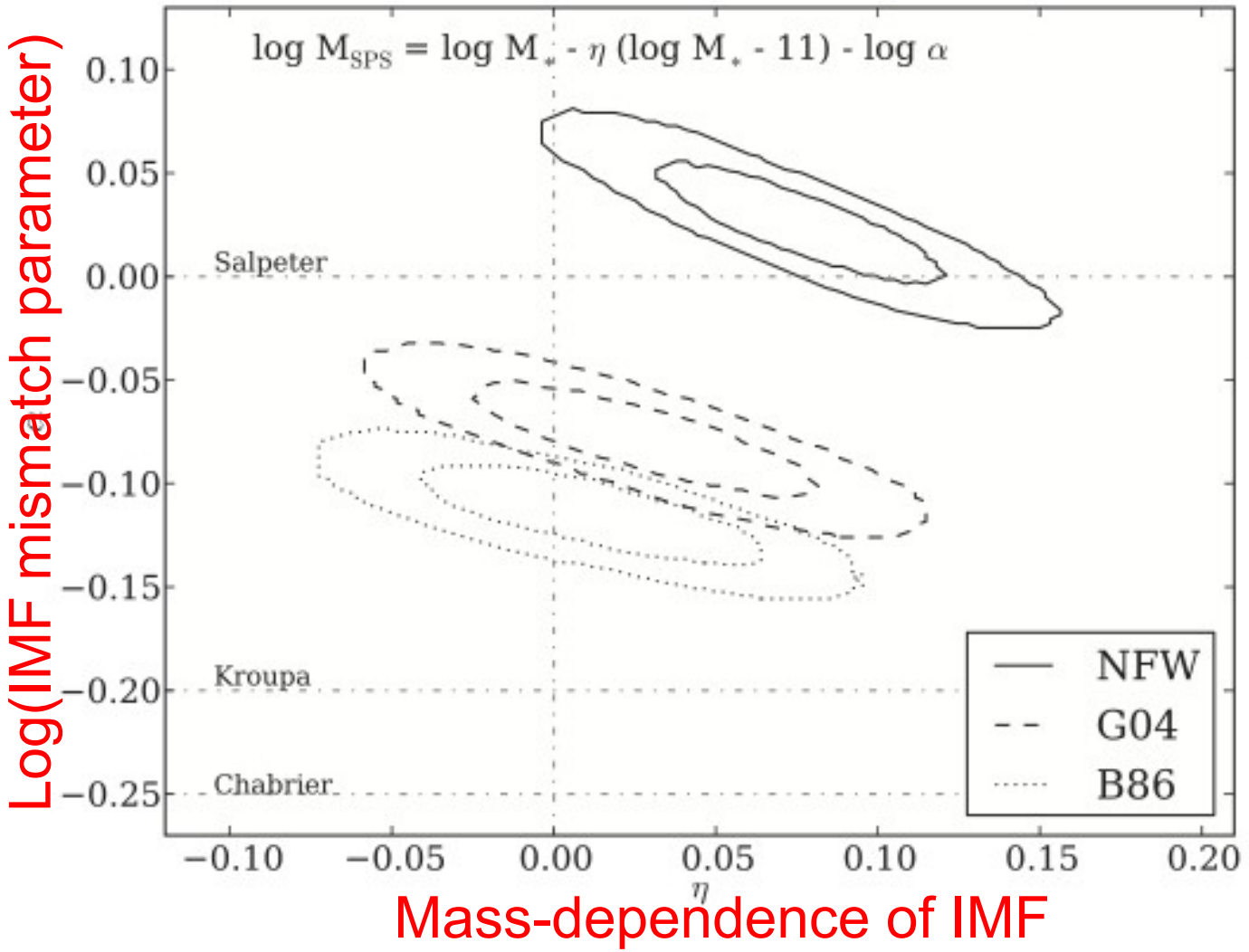


Alessandro Sonnenfeld, Anupreeta More, Masamune Oguri, Sherry Suyu, James Chan, Kenneth Wong

Science with galaxy scale lenses

- Inner structure of massive galaxies
- Mass assembly of early-type galaxies
- Stellar IMF up to z~1
- Cosmology (double source lenses, time-delay)

Stellar IMF with strong lenses

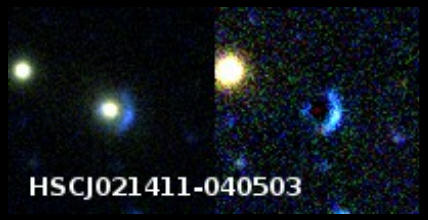


Auger et al. (2010)

Lens zoo

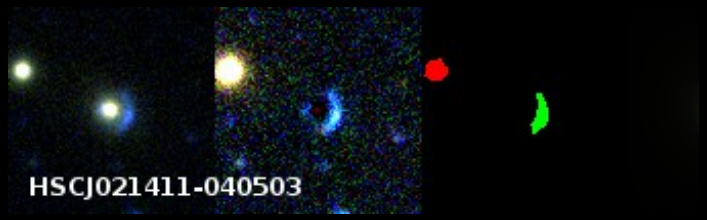
YattaLens

YattaLens



1. Remove light from the lens

YattaLens



1. Remove light from the lens
2. Search for blue tangentially elongated features with Sextractor

YattaLens

1. Remove light from the lens
2. Search for blue tangentially elongated features with Sextractor
3. Run a lens model

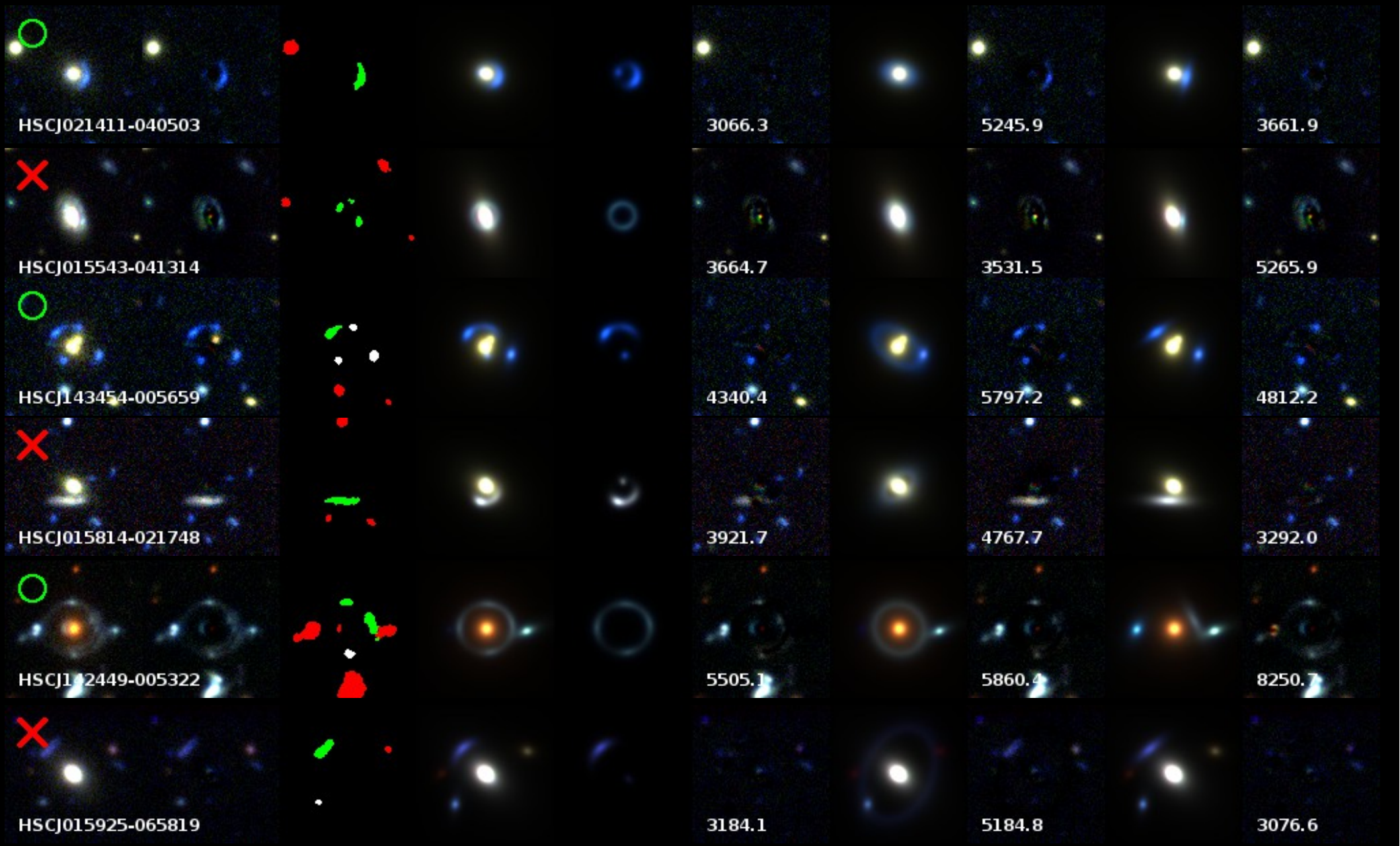
YattaLens

1. Remove light from the lens
2. Search for blue tangentially elongated features with Sextractor
3. Run a lens model
4. Compare lens model with alternative models (“ring” and “Sersic”)

YattaLens

1. Remove light from the lens
2. Search for blue tangentially elongated features with Sextractor
3. Run a lens model
4. Compare lens model with alternative models (“ring” and “Sersic”)
5. ヤッター！

YattaLens

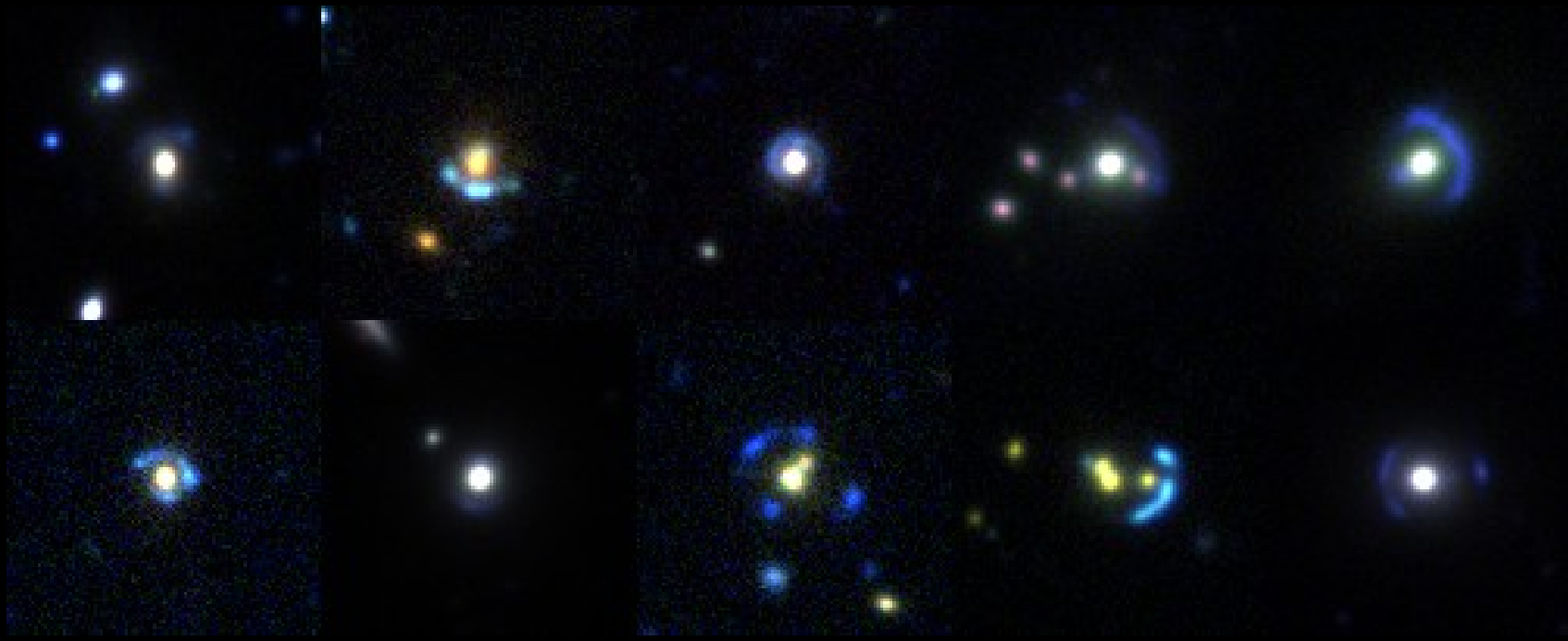


A. Sonnenfeld, IPMU

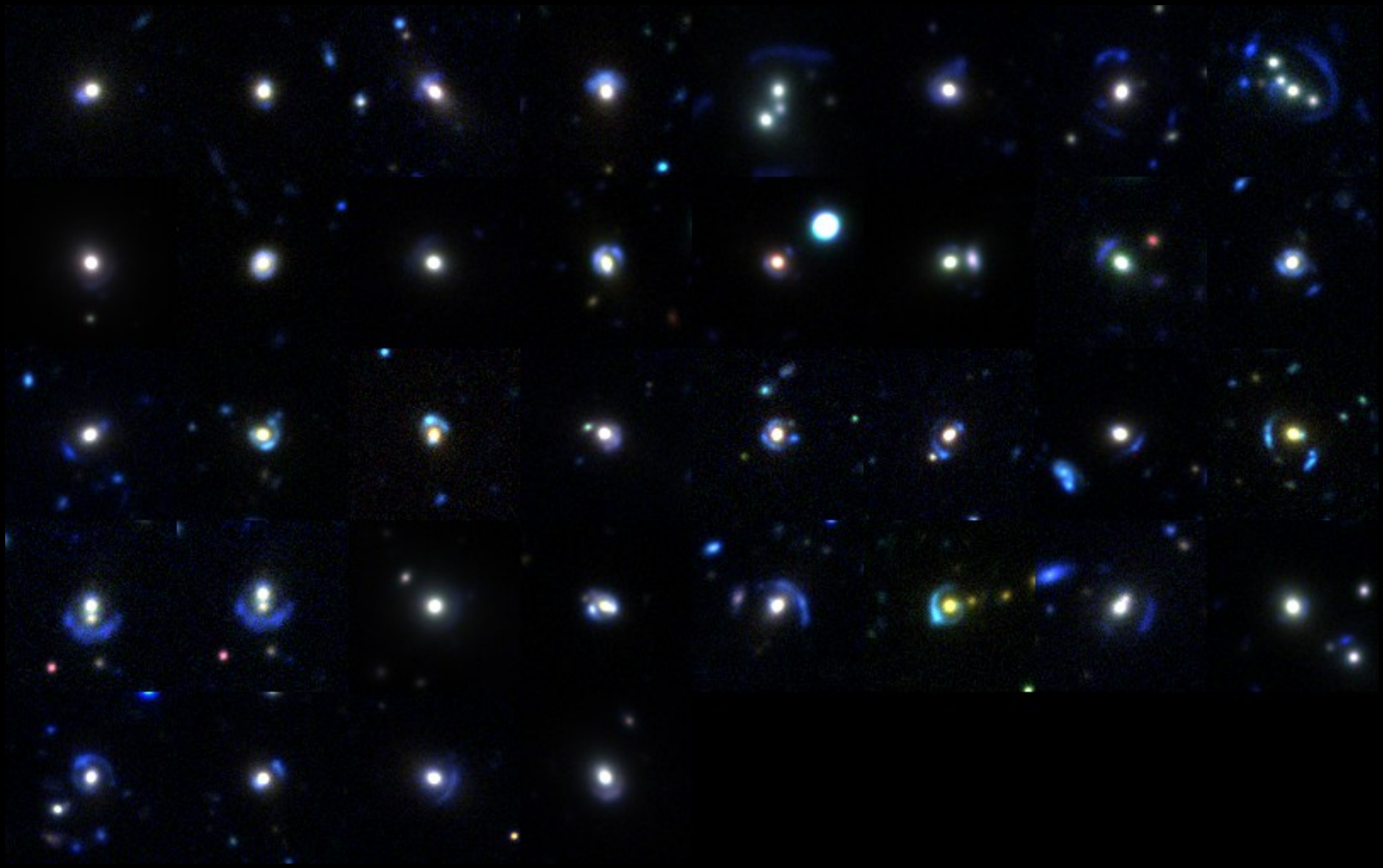
YattaLens performance

- Run YattaLens on ~40,000 BOSS galaxies in HSC 16A
- SExtractor selection ~3,500 (8%)
- Modeling selection ~900 (2%)
- 10 new Grade A lenses (definite lenses)
- 36 new Grade B lenses (probable lenses)
- ~100 Grade C (possible lenses)

Grade A lenses



Grade B lenses



SUGOHI: Survey of Gravitationally lensed Objects in HSC Imaging

SUGOHI I: automatic search for galaxy-galaxy strong lenses in the HSC survey

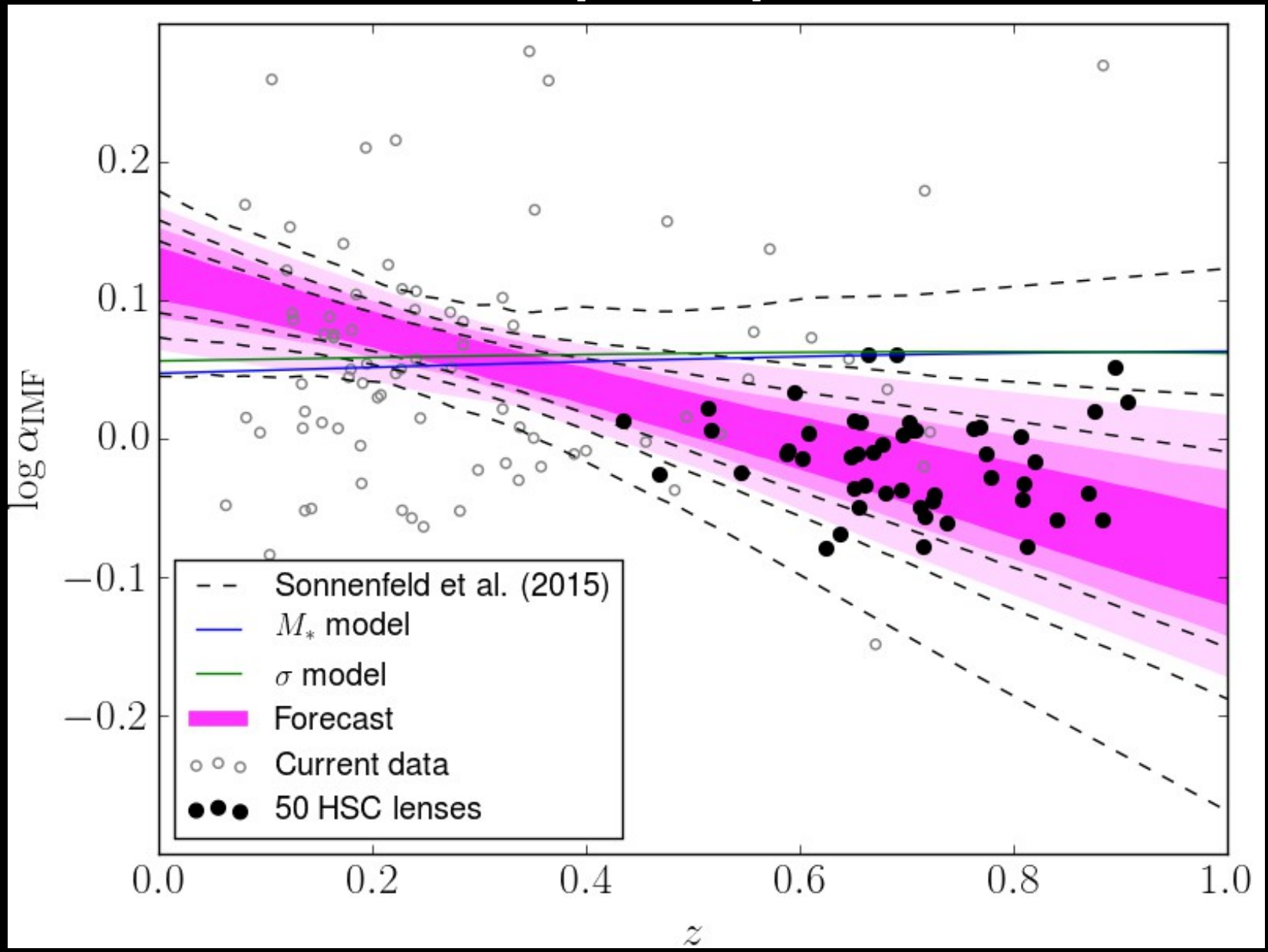
Alessandro Sonnenfeld,[1]★ Anupreeta More,[1] Masamune Oguri,[1,2] Yiping Shu,[3]
Sherry H. Suyu,[4] James H. H. Chan,[5] Kenneth C. Wong,[6]
[1]*Kavli IPMU (WPI), UTIAS, The University of Tokyo, Kashiwa, Chiba 277-8583, Japan*
[2]*Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan*
[3]*National Astronomical Observatories, Chinese Academy of Sciences, 20A Datun Road, Chaoyang District, Beijing 100012, China*
[4]*1Max-Planck-Institut fur Astrophysik, Karl-Schwarzschild-Str. 1, 85748 Garching, Germany*
[5]*Department of Physics, National Taiwan University, 10617 Taipei, Taiwan* [6]*National Astronomical Observatory of Japan, 2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan*

SUGOHI includes lenses from other search methods: visual inspection of clusters (Oguri, More) and automatic detection of lensed QSOs (Chan, Suyu)

Spectroscopic follow-up

- In order to accurately measure lens masses we need redshifts of both the lens and source galaxy
- Lensed sources have a redshift distribution $1 < z < 3$: most of them have no emission lines in the optical (and too faint to detect continuum)
- No instrument on Subaru can get us source redshifts with high confidence
- We obtained 30h time with XShooter in 17A (P.I. Suyu)

Future prospects



Summary

- HSC is an excellent instrument to look for strong lenses
- 10 new secure lenses found in 16A data release, a lot more to be confirmed
- Can constrain IMF evolution up to z=1, provided we can get spectroscopic follow-up of ~50 systems