Mass Estimates from Pixel-by-Pixel SED Fitting: The whole is not equal to the sum of the parts

Robert Sorba   Marcin Sawicki

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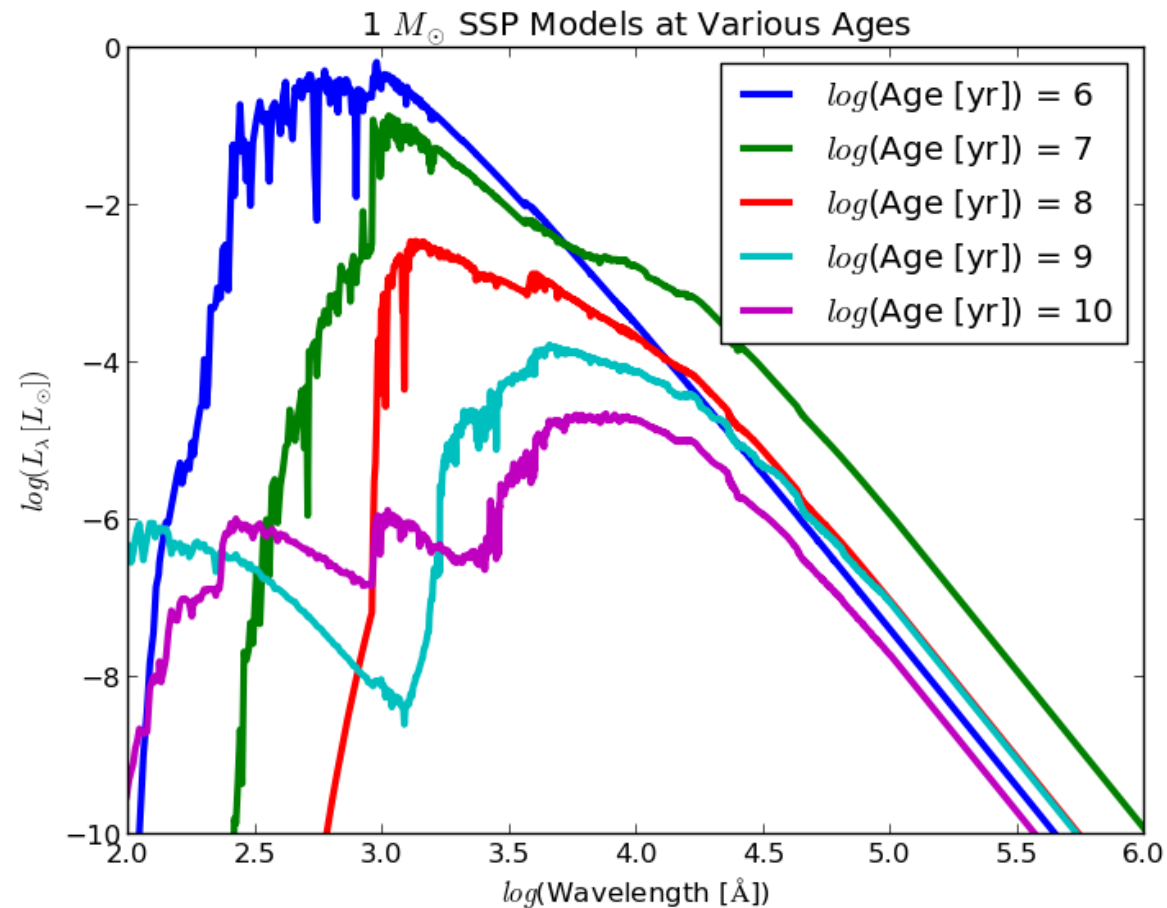**SAINT MARY'S UNIVERSITY** SINCE 1802

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ACEnet

Young stars are much brighter than old stars.

Models made using FSPS (Conroy, Gunn, & White 2009; Conroy & Gunn 2010)

Outshining Over-Simplified
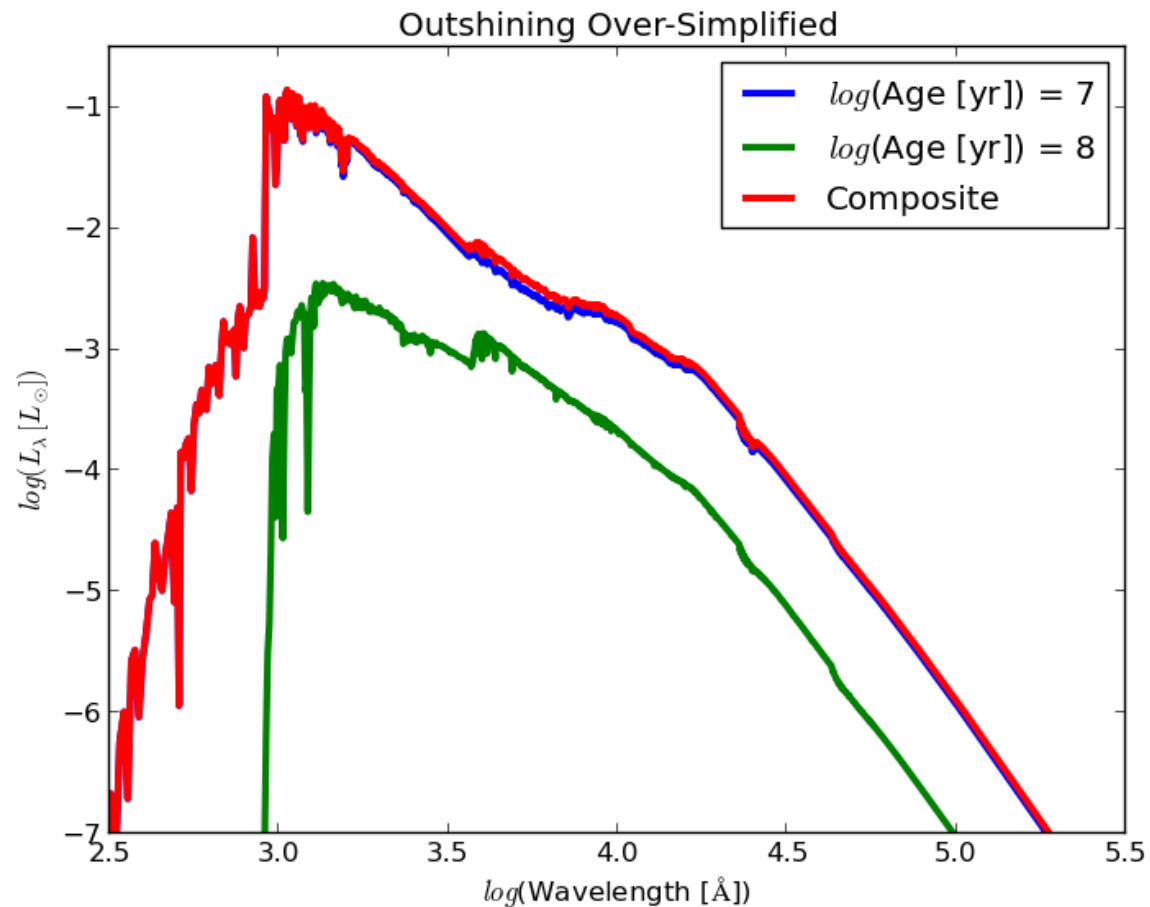
Suppose observing galaxy with red spectrum, but only have blue and green spectral models $\implies$ underestimate stellar mass

NGC 4321 V band flux

Fit SED to each pixel in a galaxy to get resolved stellar property maps.

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■ SINGS survey

■ Use galaxies with complete NUV, B, V, R, I data

■ Focus on face-on galaxies

■ 26 galaxies (20 spiral, 5 elliptical, 1 irregular) with $z_{avg} = 0.0025$

■ Background subtraction

■ Mask foreground stars and saturated pixels

■ Convert to same pixel scale (1.5" from Galex nuv images)

■ Convolve to broadest PSF

■ Apply S/N mask

■ Sum pixel fluxes to create "unresolved" broadband fluxes

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■ FSPS models

■ Salpeter IMF

■ Delayed $\tau = 1$ SFH

■ Solar metallicity

AGE

SFR

MASS

E(B-V)

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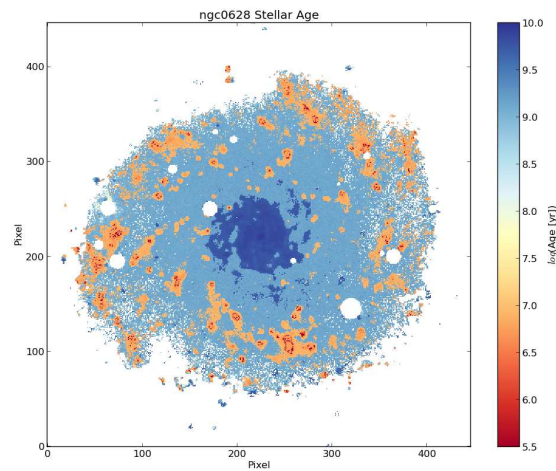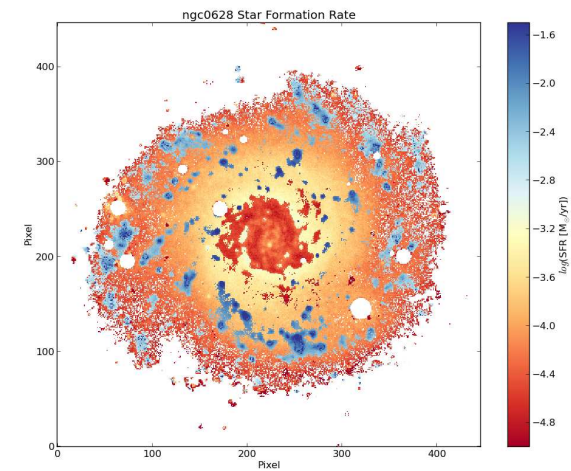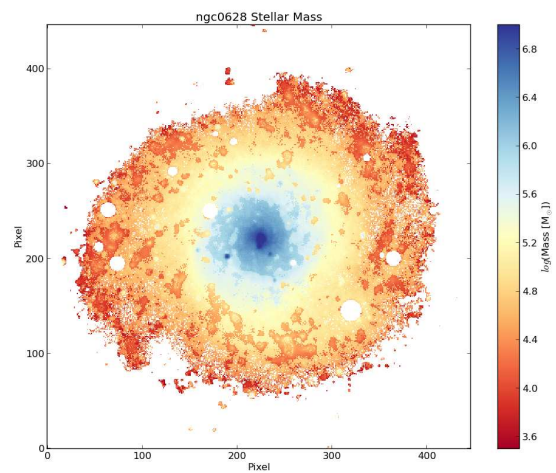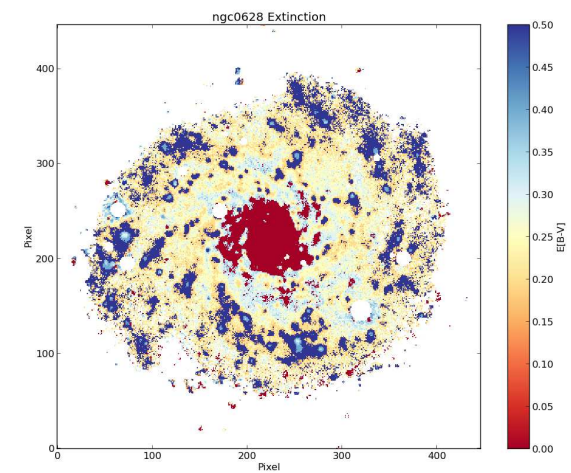
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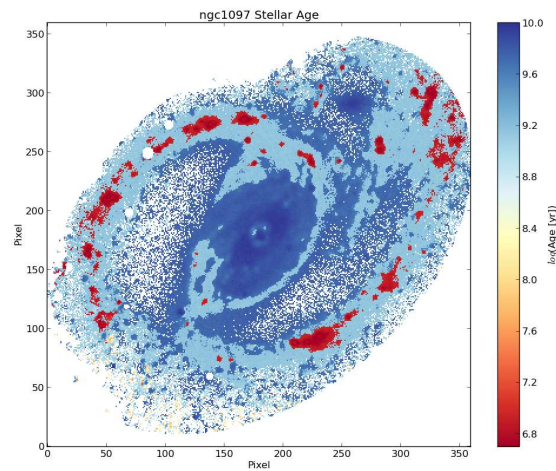
SFR

MASS

E(B-V)

AGE

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E(B-V)
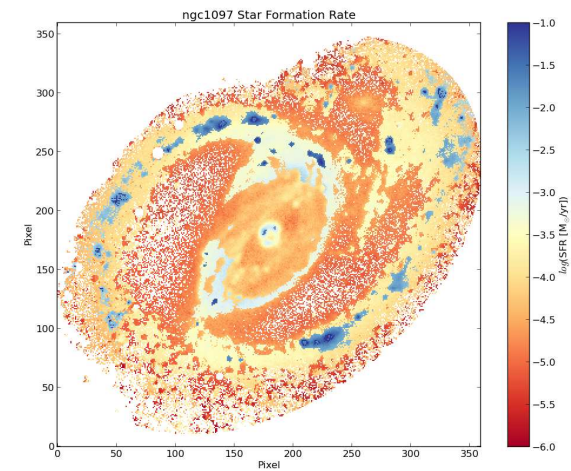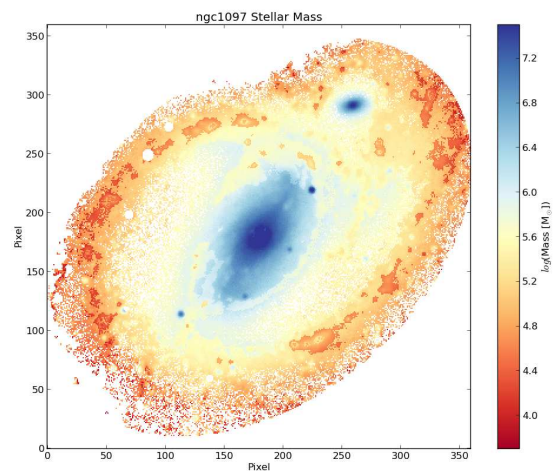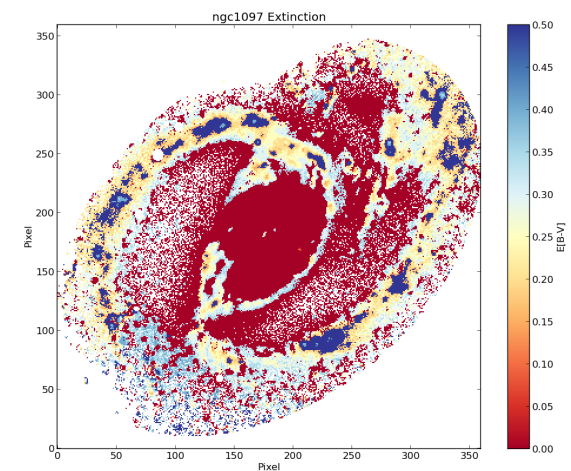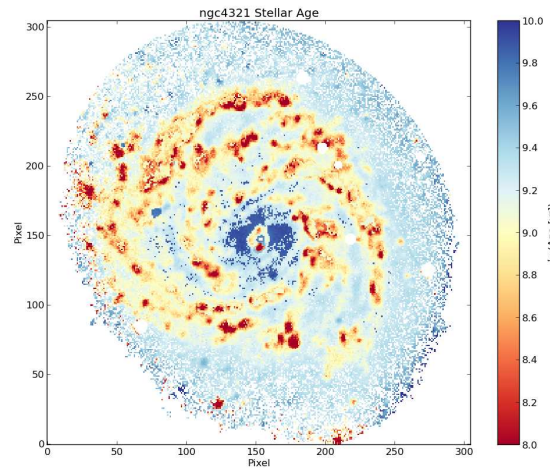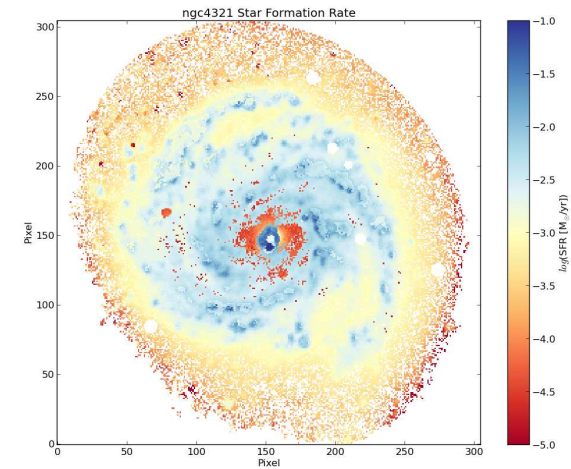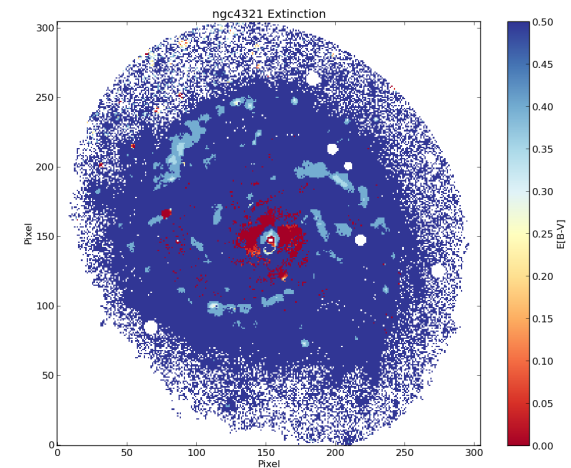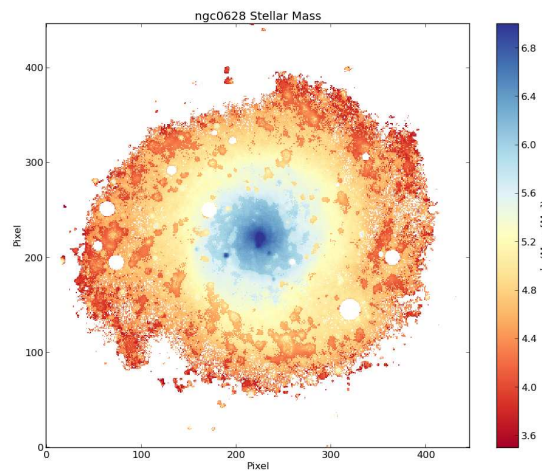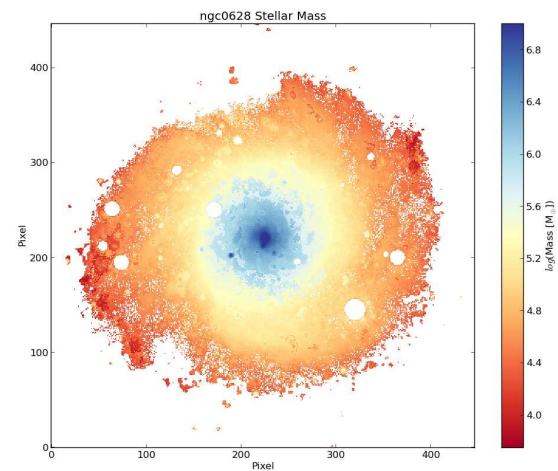
Before   *After*

Less-massive bubbles in star-forming regions are mini-example of outshining.
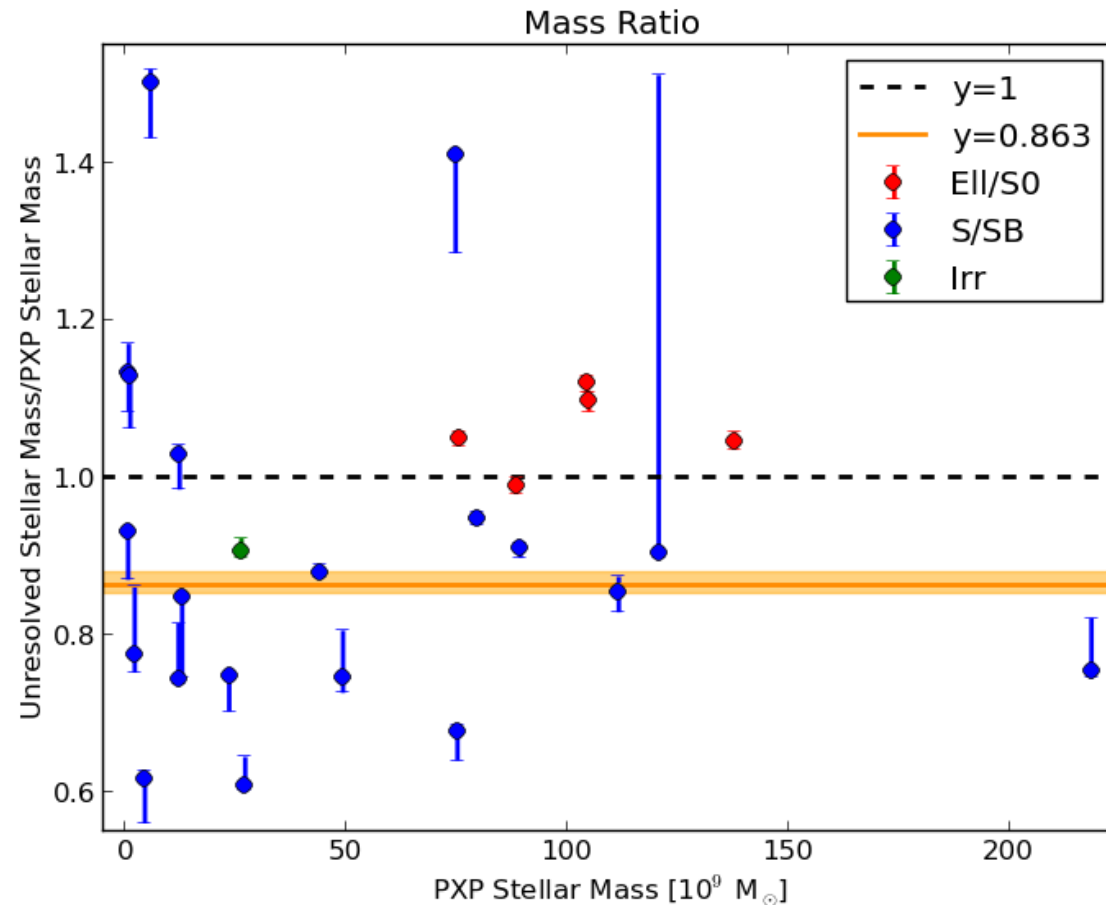
Unresolved SED fitting misses $\sim$ 15% of the stellar mass for star forming galaxies. Elliptical galaxies are not affected (probably).
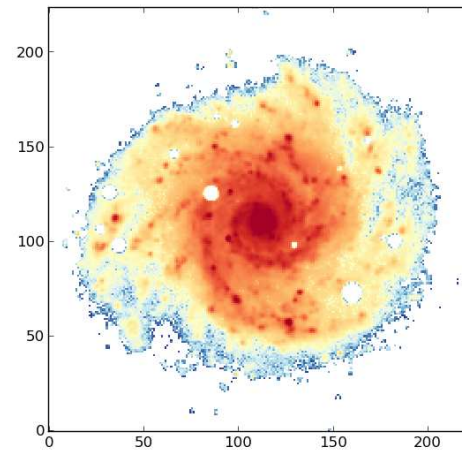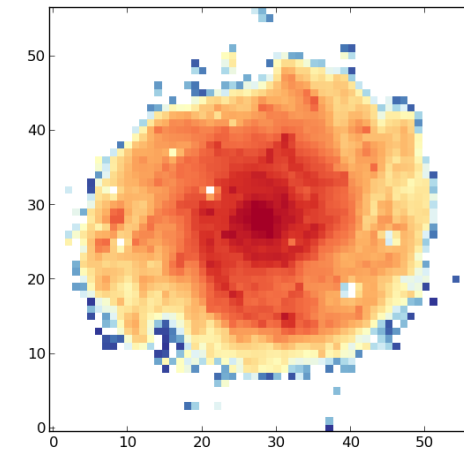
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Binning = 3

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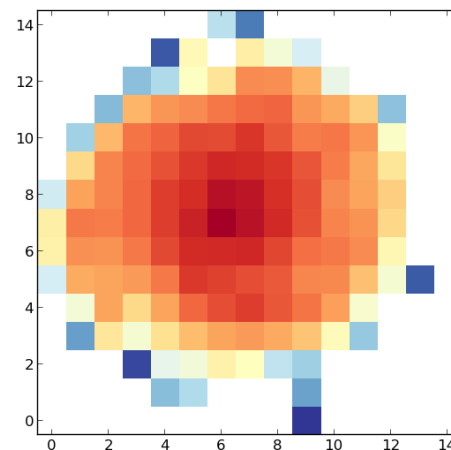
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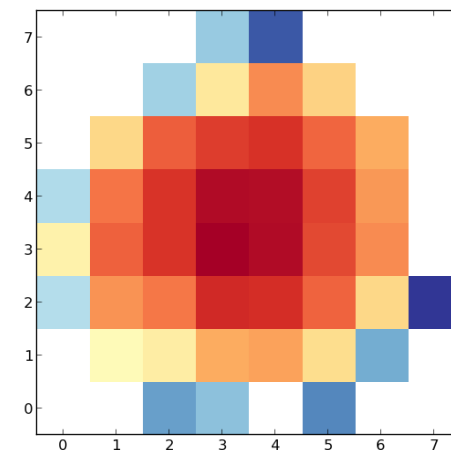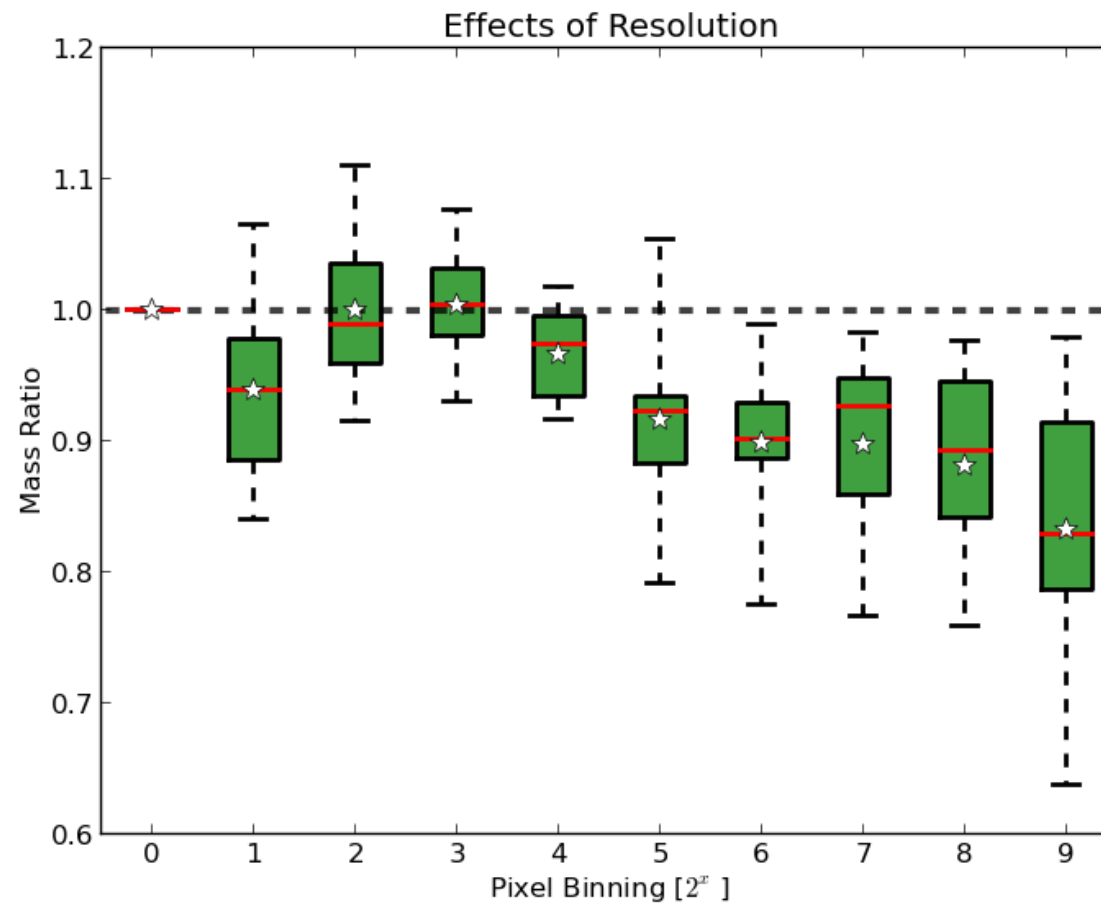
Jump between 16 and 32 pixels corresponds approx. to the width of spiral arms.

Ilbert et al. 2013
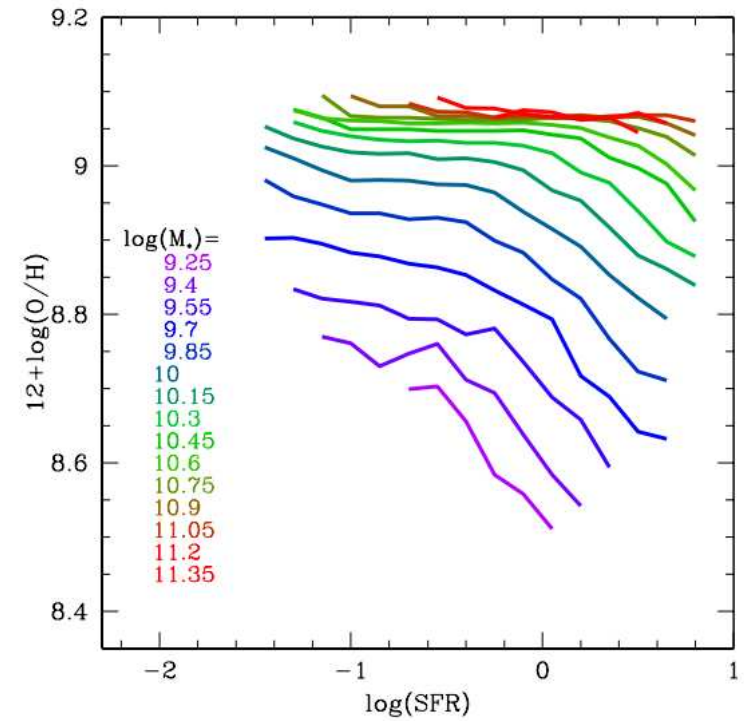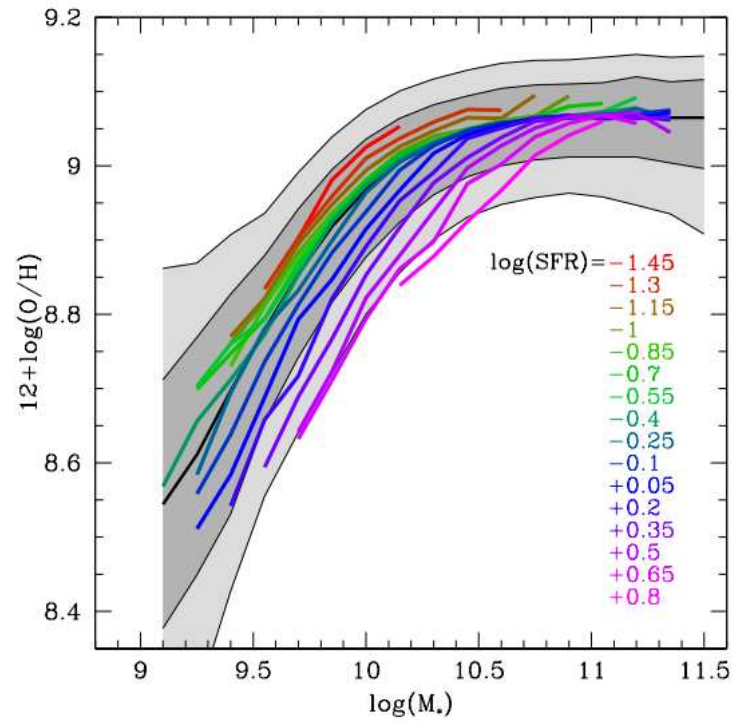
Mannucci et al. 2010

Miller et al. 2011

■ Would more data affect the results in any way?

■ Are stellar masses of ellipticals over-predicted?

■ How does outshining change at higher redshift?

■ Performed PxP SED fitting on 26 SINGS galaxies and compared with unresolved SED fitting

■ Found unresolved stellar masses of star-forming galaxies missed approx. 15% of the mass on average

■ Need to resolve at the level of about a kpc to see difference between PxP and unresolved mass estimates

■ This systematic offset has small quantitative implications for many current relations, typically shifting the relations by 0.06 dex

QUESTIONS?