The Secular Growth of Galaxies & Black Holes

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@the_zooniverse @galaxyzoo @vrooje

Merger-Free Co-Evolution?

Schawinski+11, Simmons+12

Simmons+11

Treister+12

$\Longrightarrow$ Goal: isolate merger-free BH growth pathway

CLASSIFY SCIENCE STORY GALAXY ZOO ASTRONOMERS DISCUSS PROFILE

Classify

SDSS Favourite Invert

Help Restart

BULGE

How prominent is the central bulge, compared with the rest of the galaxy?

No bulge

Just noticeable

Obvious

Dominant

Humans: A+ Pattern Detectors

Classify

SDSS Favourite Invert

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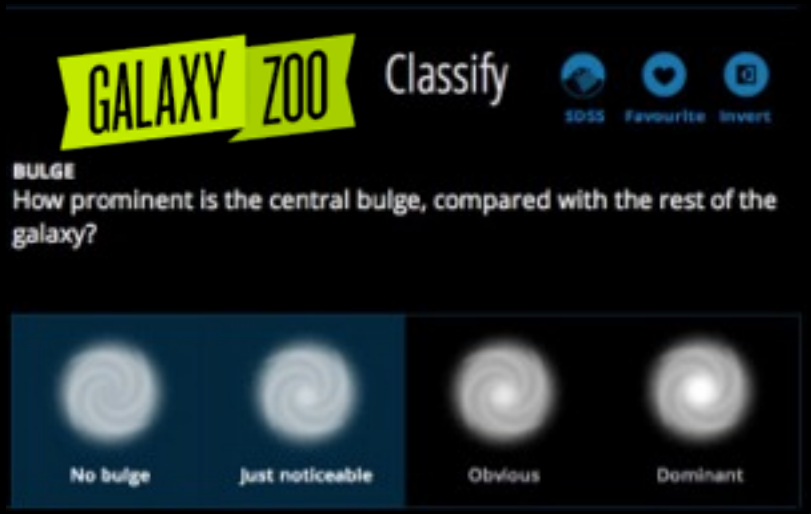
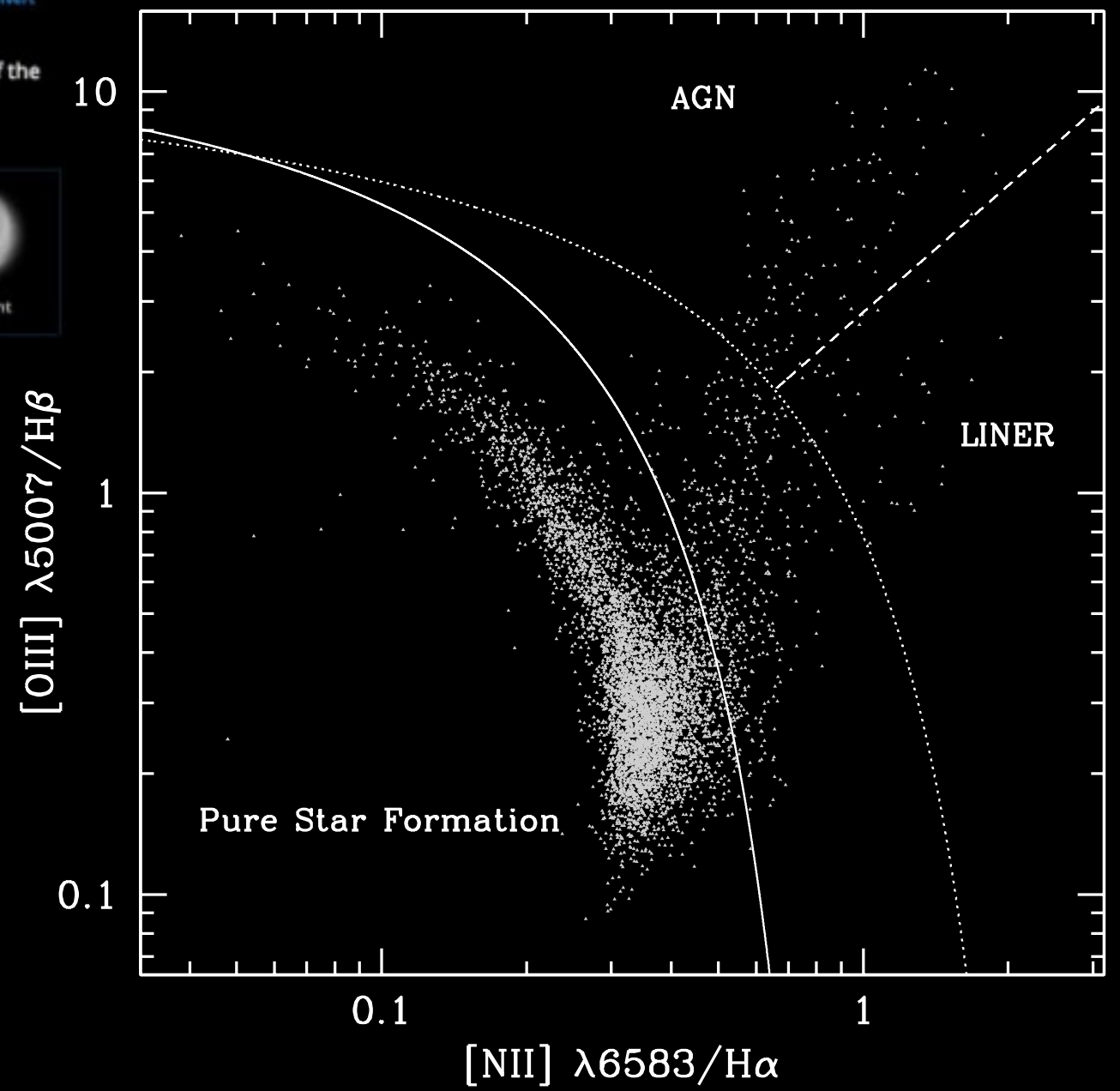
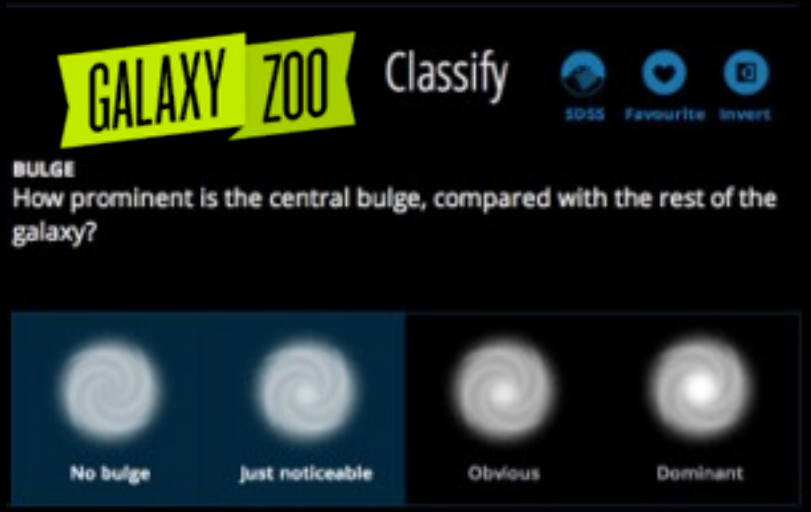
Bulgeless Galaxies with Growing Black Holes



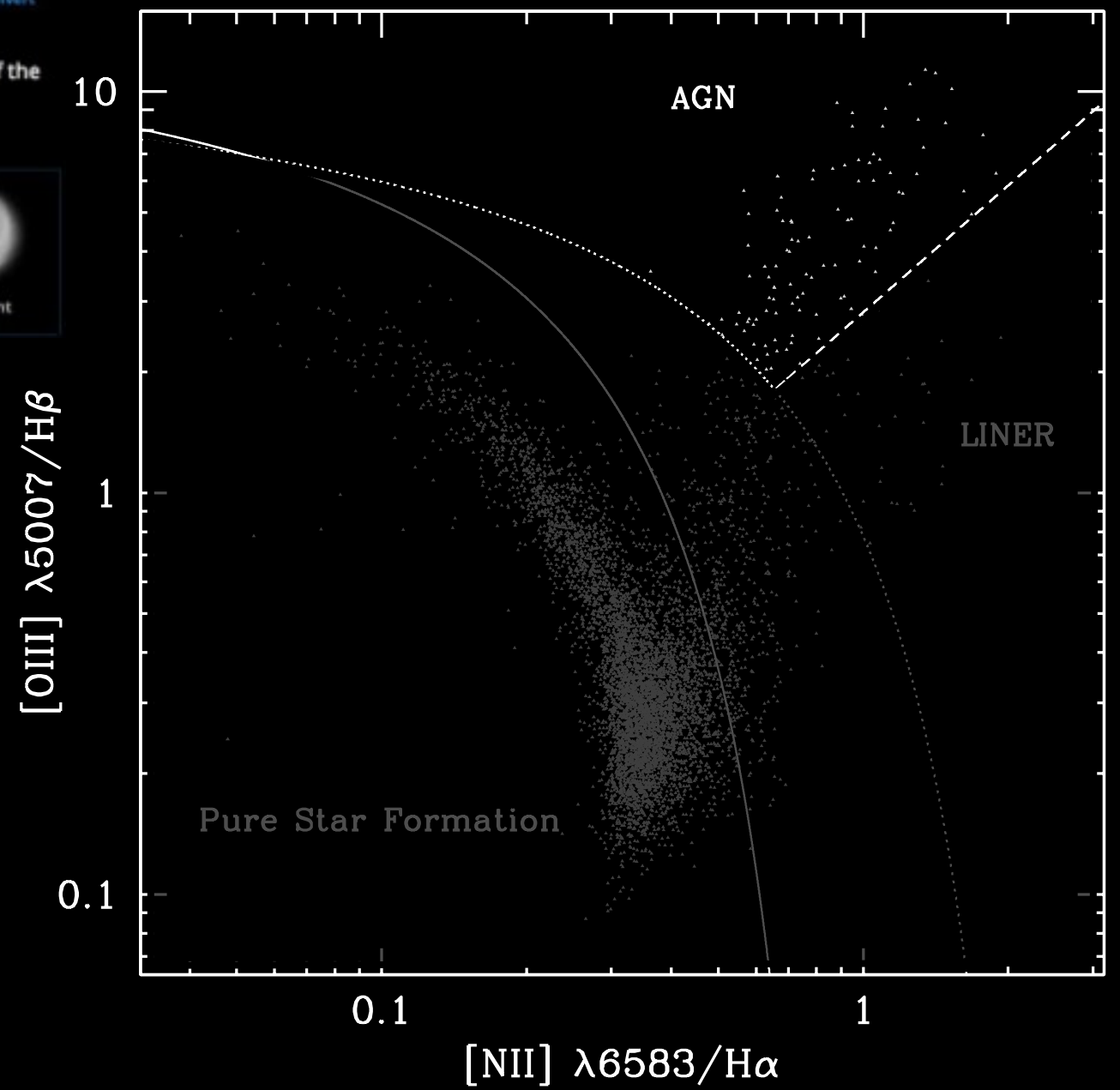


Simmons+13

Bulgeless Galaxies with Growing Black Holes



100 potentially bulgeless AGN



Simmons+13

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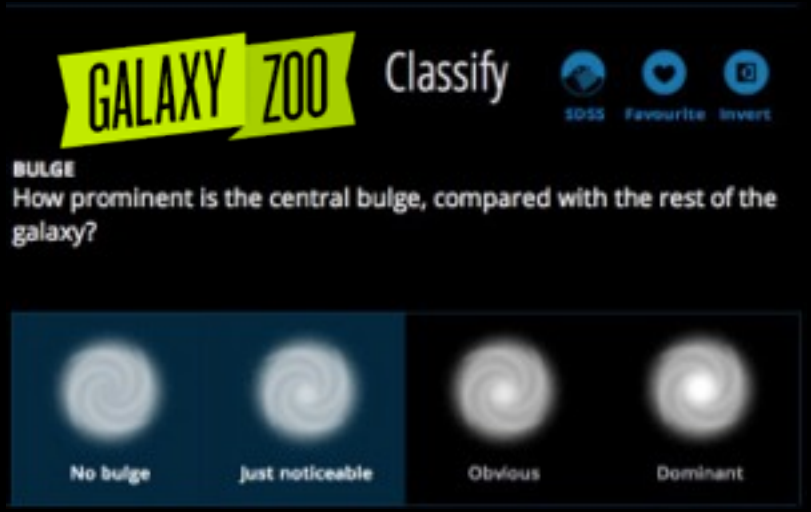
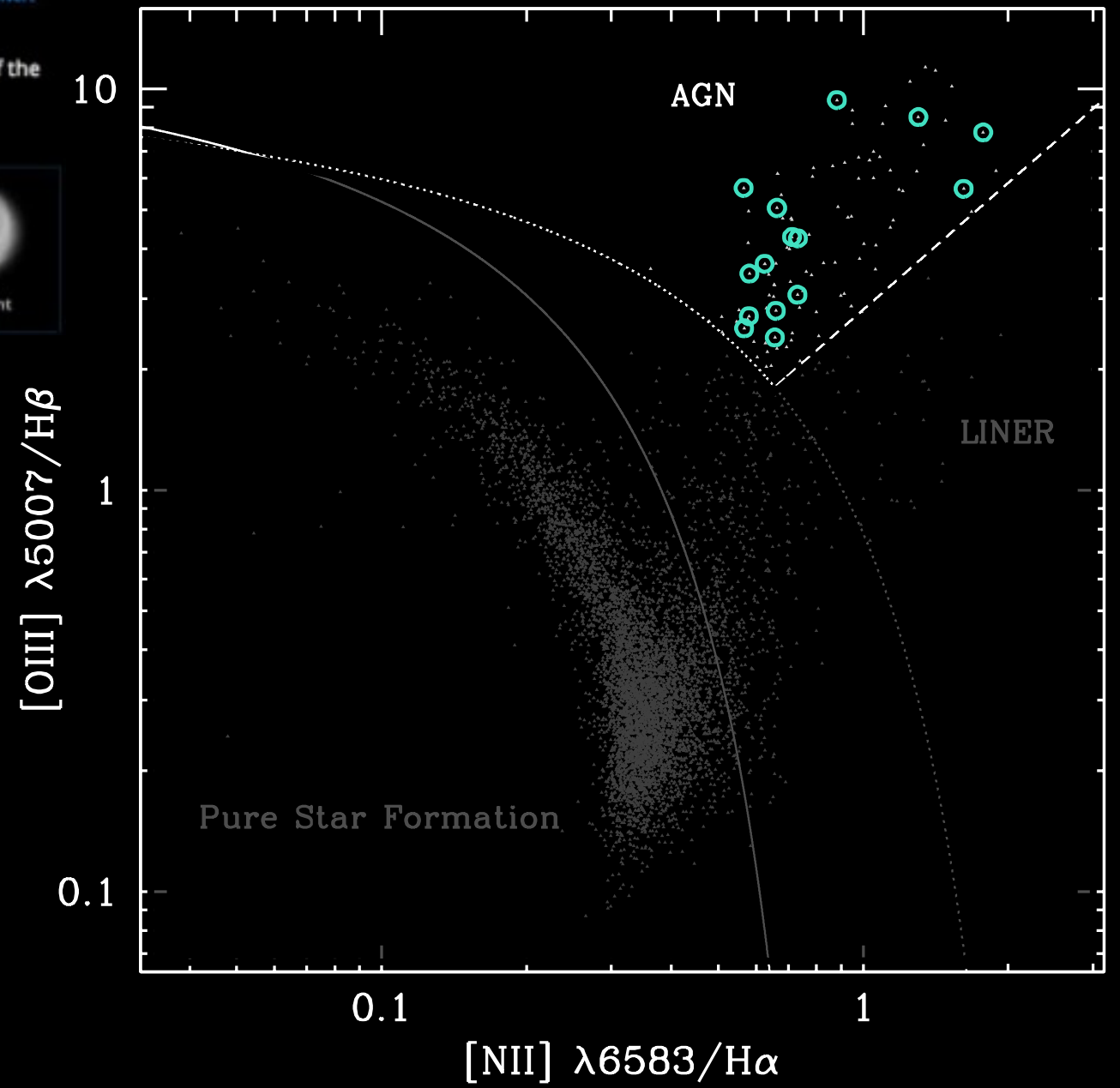


100 potentially bulgeless AGN

⟶ 15 candidates



Simmons+13

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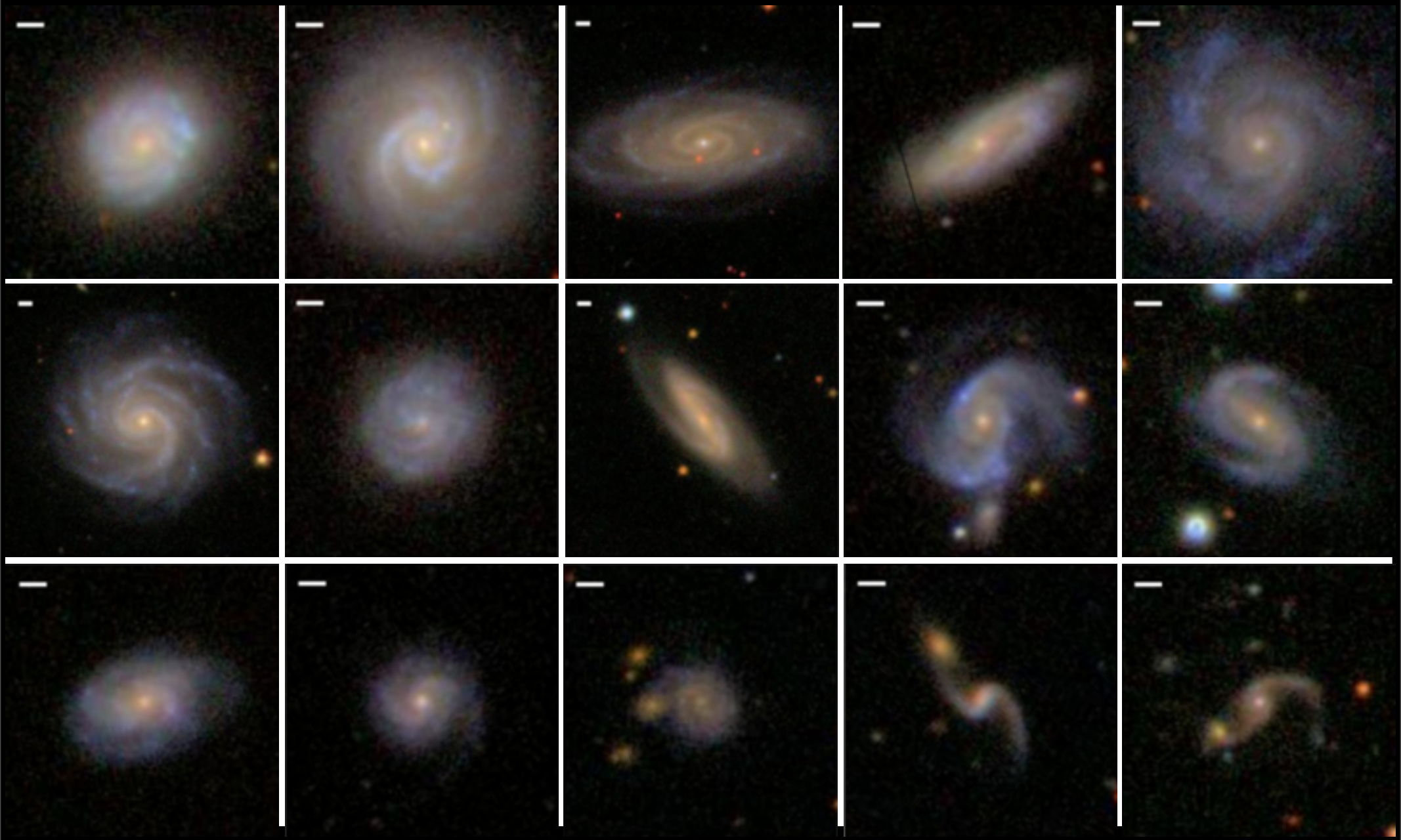

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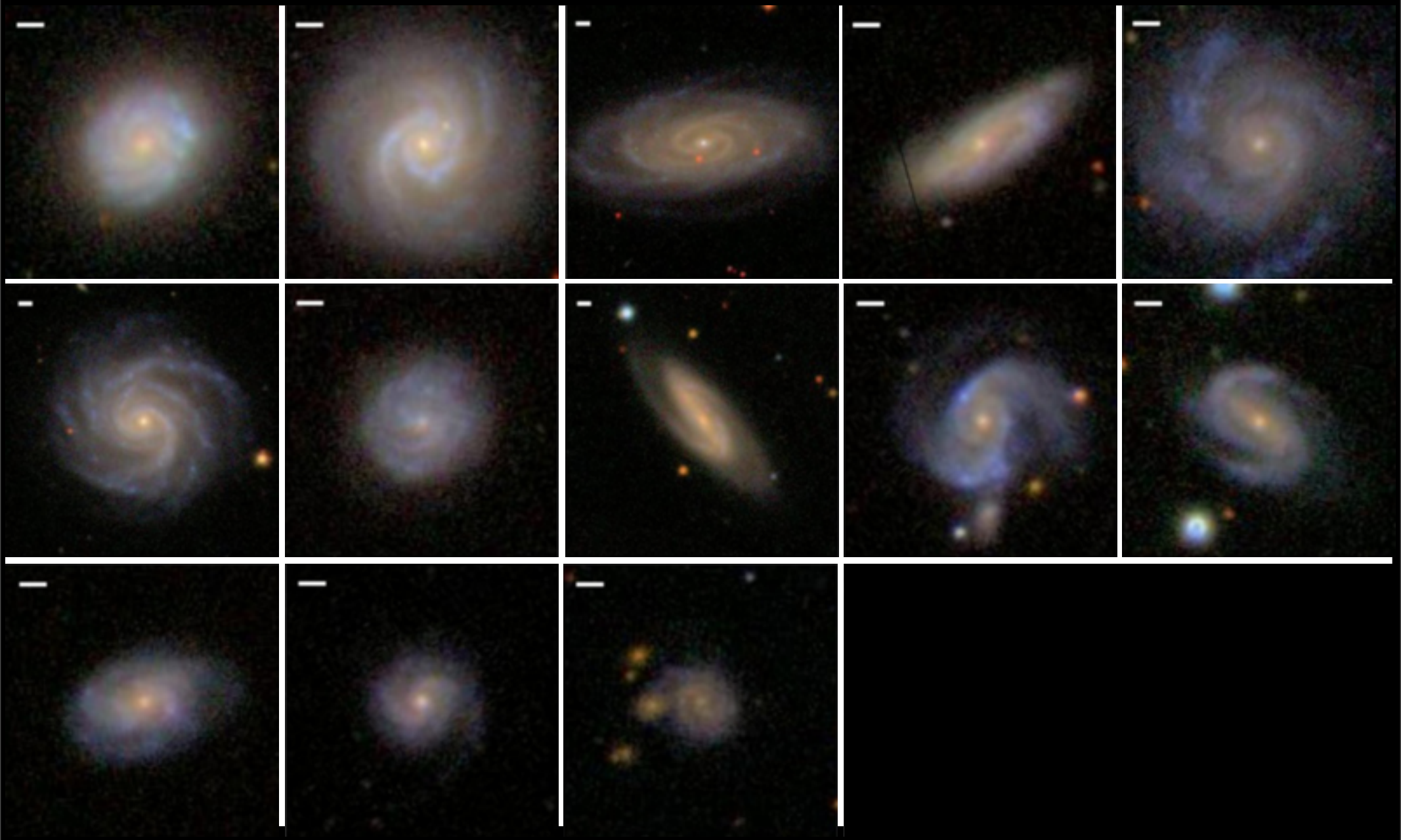

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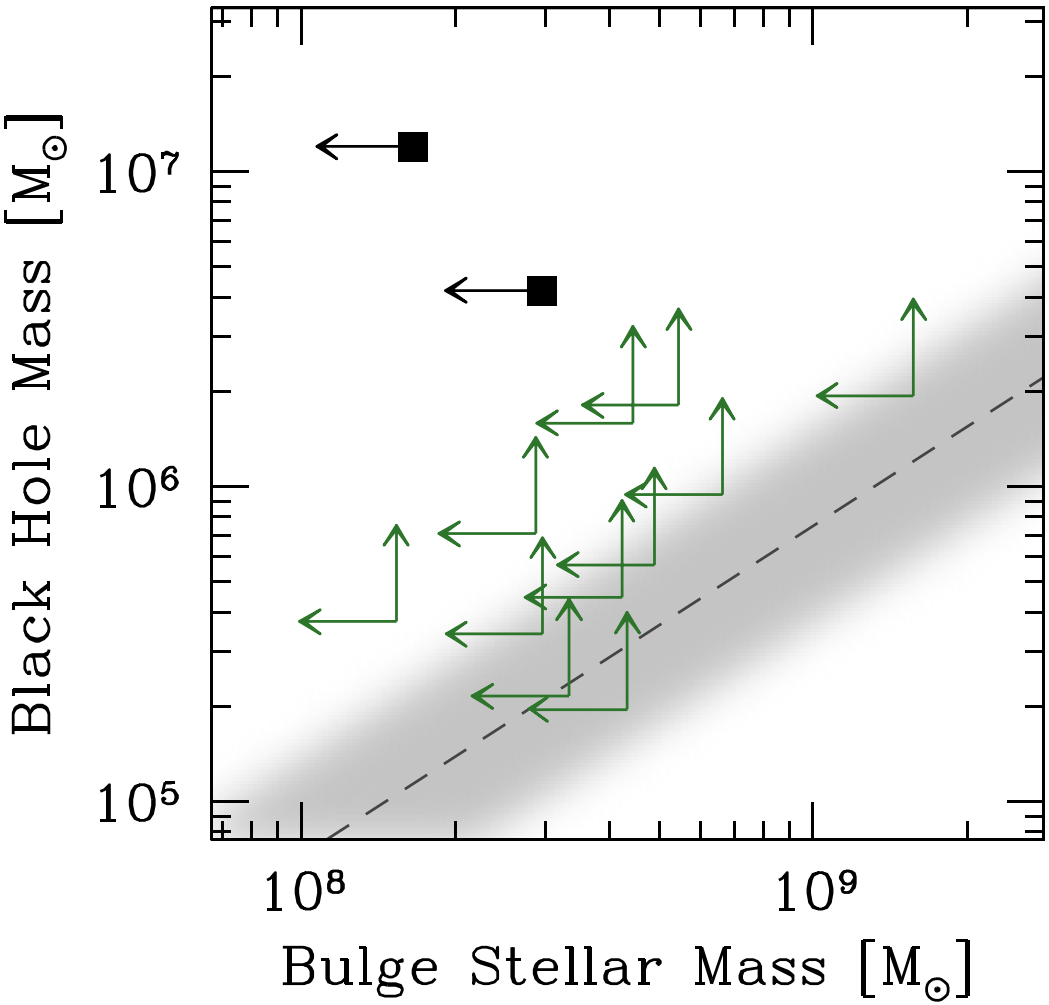
Merger-Free Black Hole Growth



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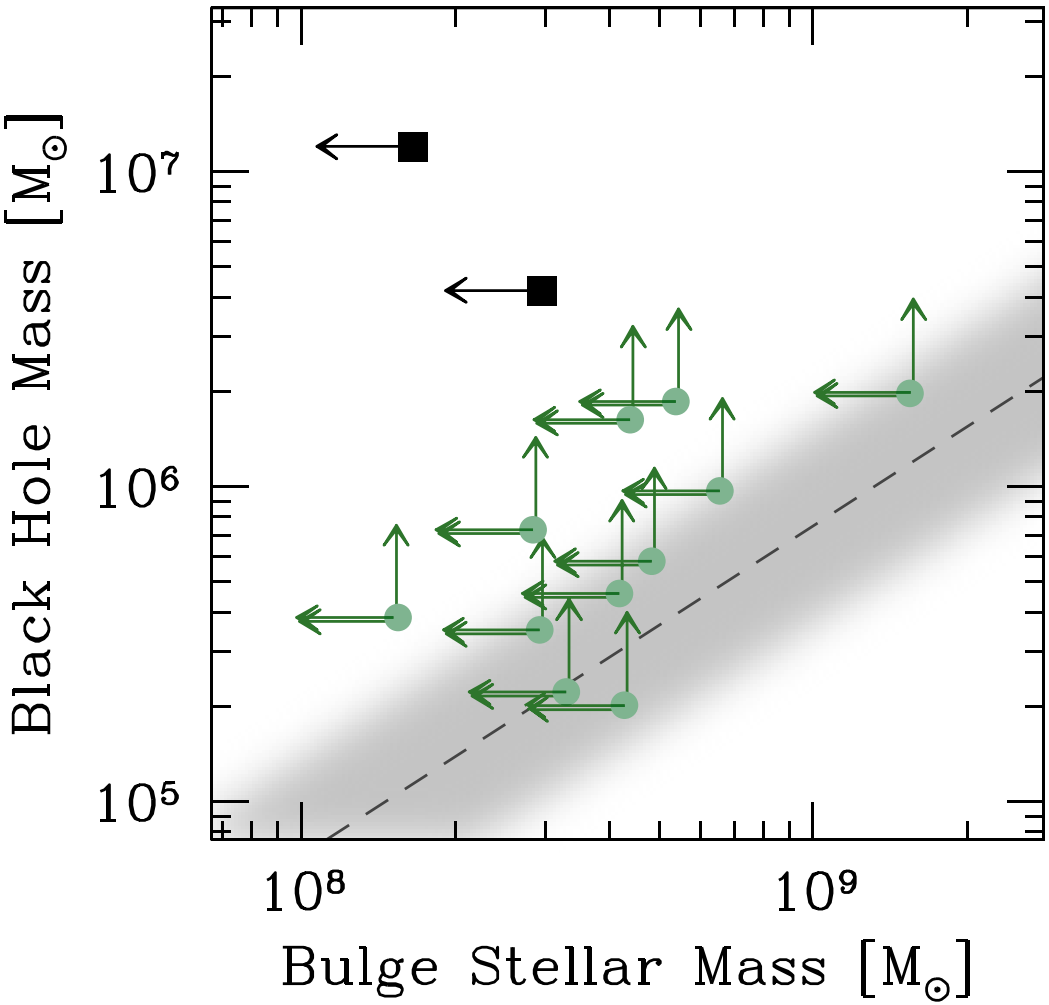

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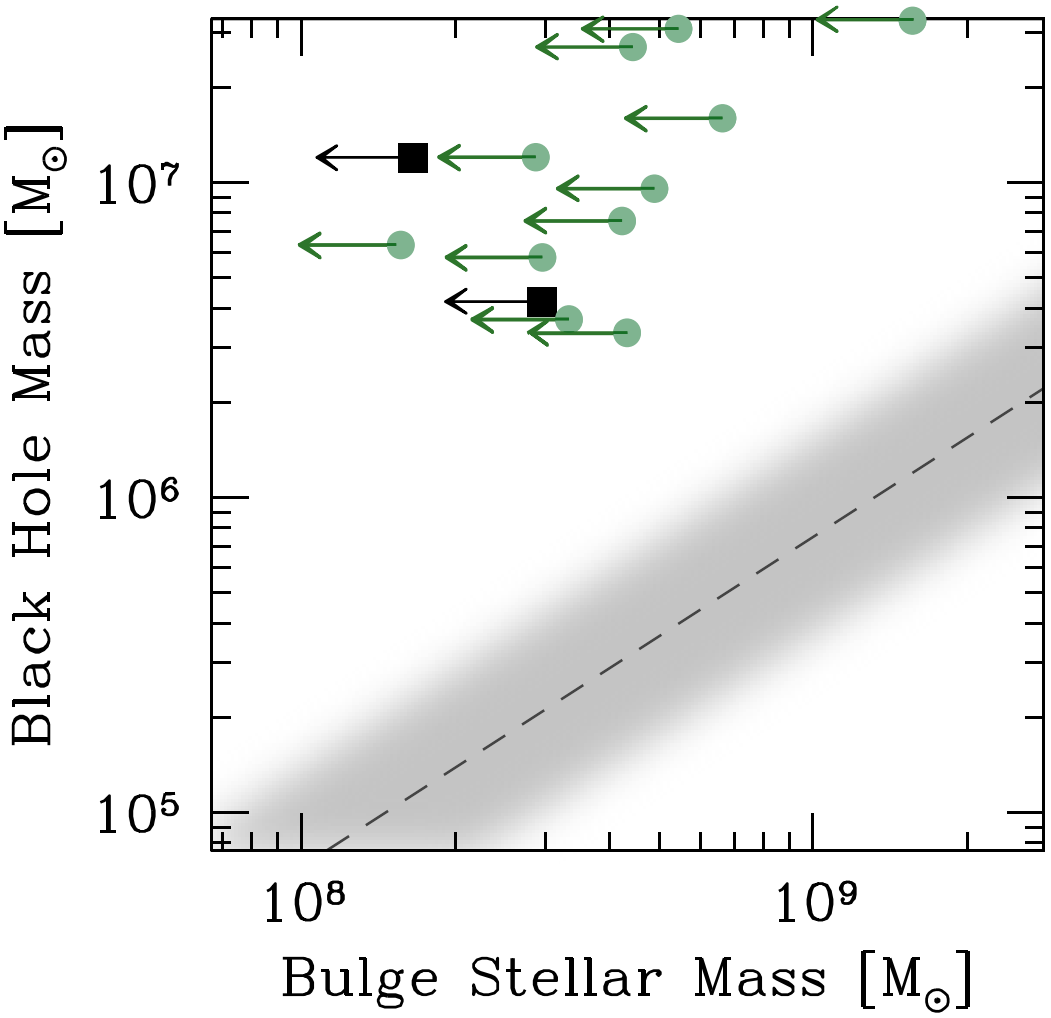

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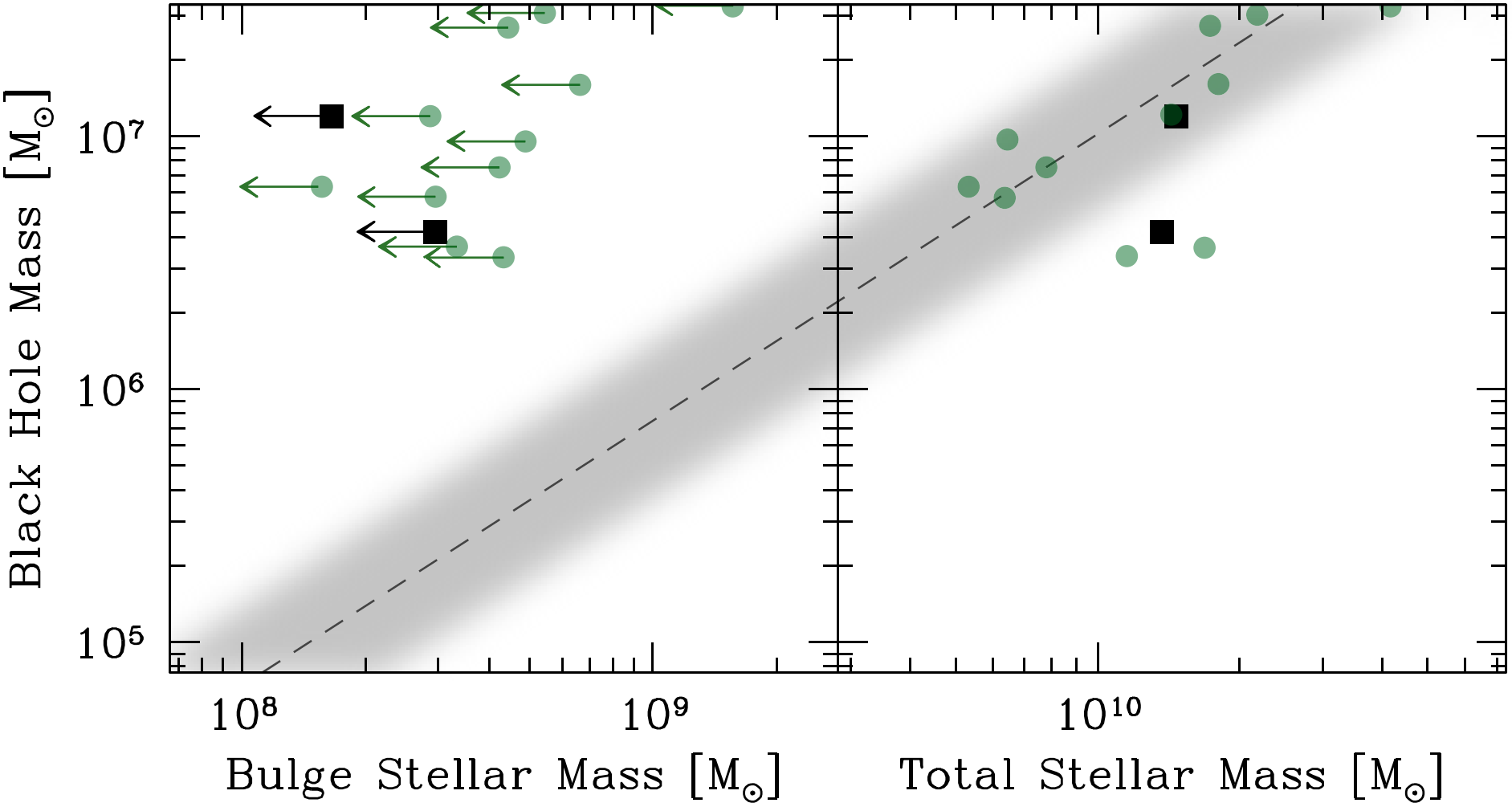
Merger-Free Black Hole Growth

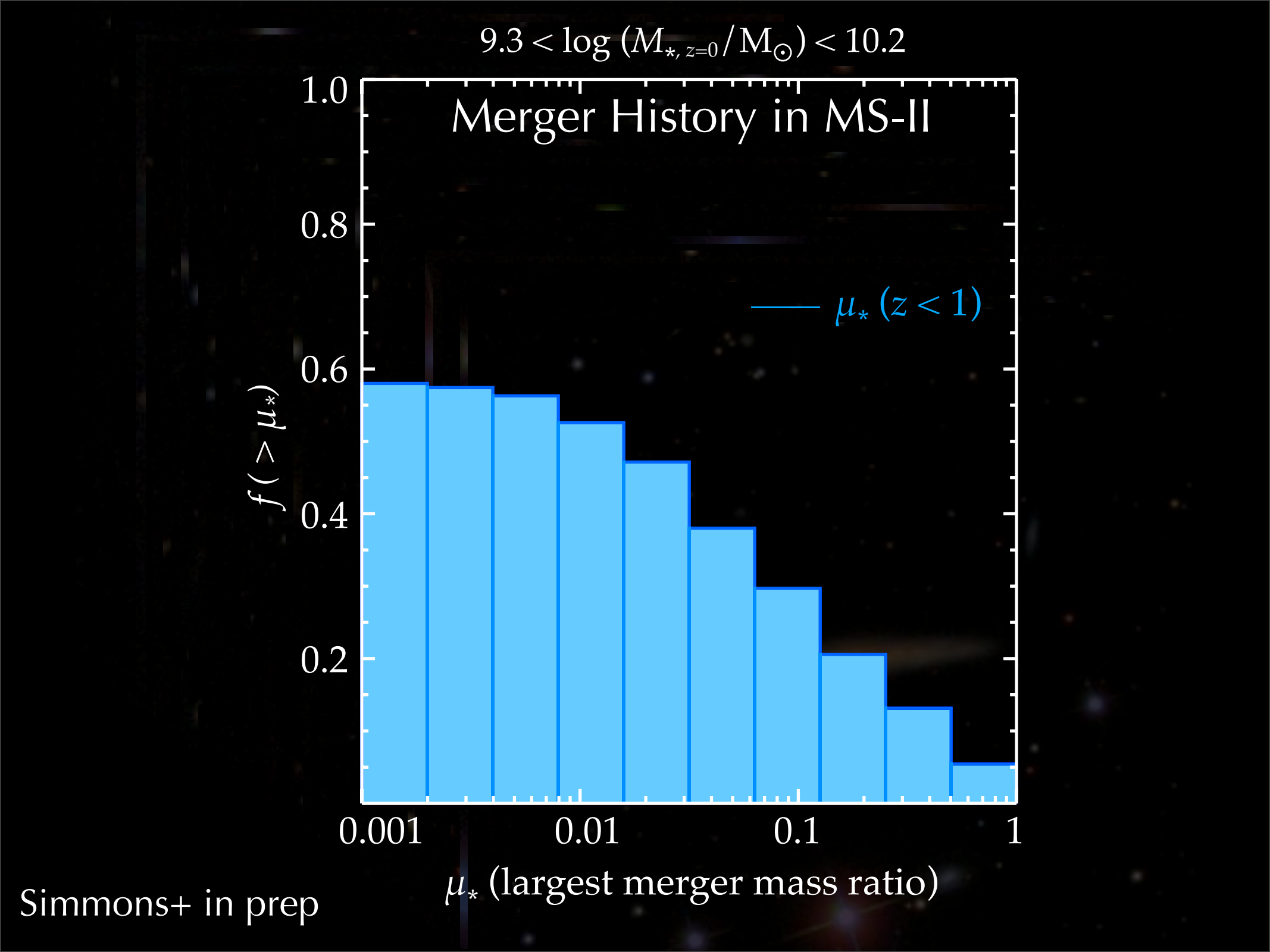
Do stellar dynamics matter to the central black hole?

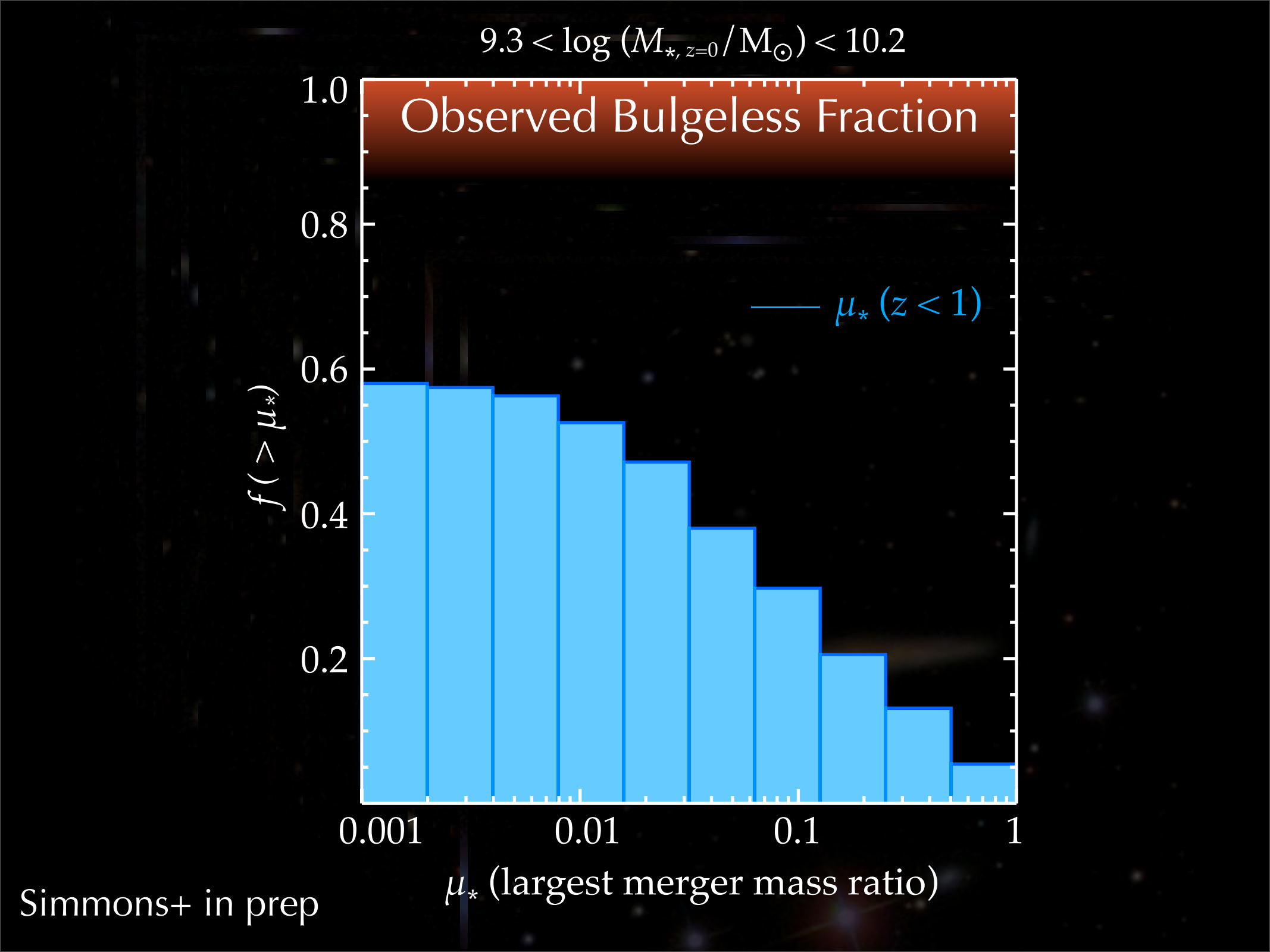


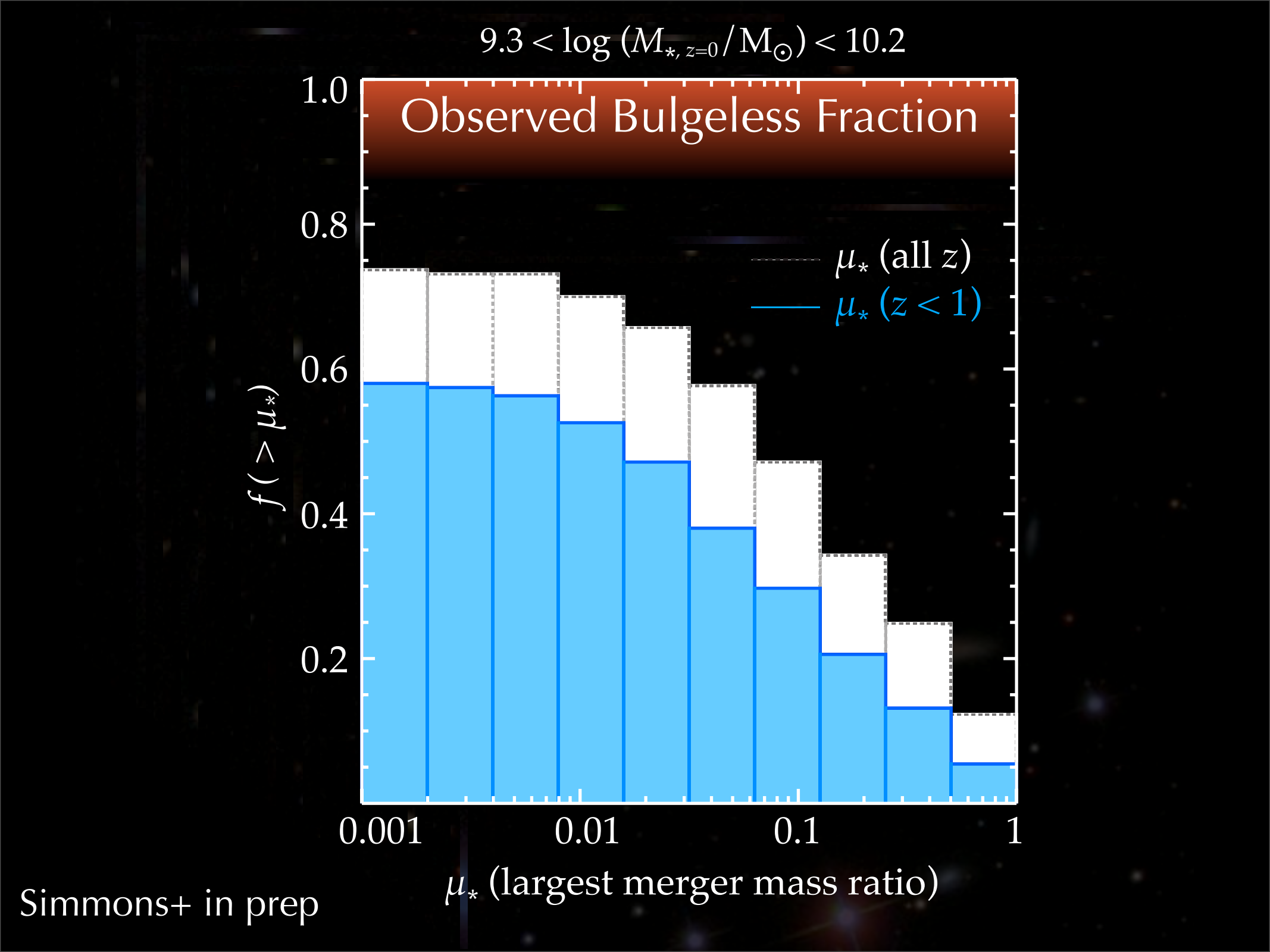
Simmons+13

Bulgeless Galaxies: Not That Rare

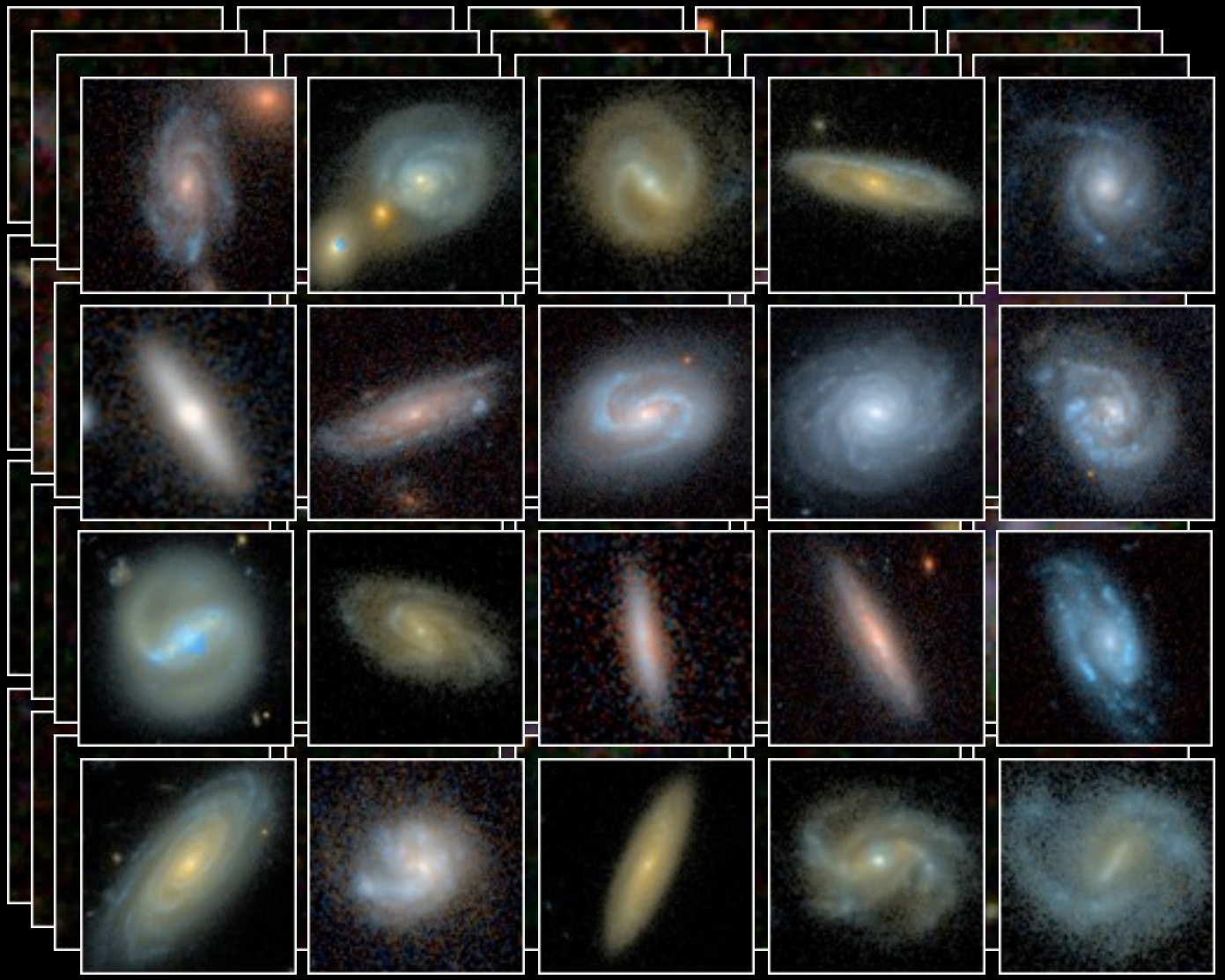
Simmons+ in prep


$9.3 < \log(M_{*,\,z=0}/\mathrm{M}_\odot) < 10.2$
Merger History in MS-II
$\mu_*\ (z < 1)$
$f\,(>\mu_*)$
1.0
0.8
0.6
0.4
0.2
0.001
0.01
0.1
1
μ_* (largest merger mass ratio)
Simmons+ in prep


$9.3 < \log(M_{*,\,z=0}/\mathrm{M}_\odot) < 10.2$
Observed Bulgeless Fraction
μ_* $(z < 1)$
$f(>\mu_*)$
1.0
0.8
0.6
0.4
0.2
0.001
0.01
0.1
1
μ_* (largest merger mass ratio)
Simmons+ in prep


$9.3 < \log(M_{*,\,z=0}/\mathrm{M}_\odot) < 10.2$
Observed Bulgeless Fraction
μ_* (all z)
μ_* ($z < 1$)
$f(>\mu_*)$
1.0
0.8
0.6
0.4
0.2
0.001
0.01
0.1
1
μ_* (largest merger mass ratio)
Simmons+ in prep

Massive Pure Disks Host Massive BHs



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and more than 300,000 volunteers at

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