Dear Editor and Referee

We would like to thank you both for your time, consideration, and diligence. We have addressed the comments and we hope that it now meets with your approval.

Reviewer's Comments:

Some of my previous concerns are still not fully addressed in this revision. In particular, necessary details on the Einstein radius and fiber radius stellar mass estimation are lacking. Based on what's currently presented, I suspect those are done incorrectly. I also have concerns on some of the new edits. And I urge the authors to run a full, careful check on their sample characteristics, figures, and analysis procedures, as another obvious mistake is seen.

Major comments:

>>> 1. More details on how to estimate the Einstein radius from the total stellar mass (from the MAGPHYS catalog) and dark-matter fraction within r_e/2 is needed. It looks to me that some light profile needs to be assumed, even if r_e/2 can be considered to be approximately equal to the Einstein radius.

<<< We agreed, and to that end we have now presented two paths to estimate the Einstein radius from total stellar mass. Both necessarily rely upon empirical relations between lens equation parameters and total stellar mass, which we have adopted from existing literature.

1. <u>Point mass</u>: approximates the lens candidate as a point mass system, where the lensing mass is taken to be the total mass within half the effective radius. Auger+2010 analyzes 73 SLACS lenses and presents a fit for the direct relation between the total stellar mass and the “lensing” mass, which is the inferred mass (stellar and DM) within half the effective radius of the lens galaxy. This relation is shown in the paper, which we use to calculate the enclosed “lensing” mass (which we denote M_E) for use in the point mass estimate. Since this relation directly relates the stellar mass to the parameter M_E in the point mass Einstein radius equation, there is no need for estimates of dark matter fractions or stellar contributions to M_E. This is the most appropriate point-mass estimate that can be made given the available data, as it accounts for only the matter (stellar and DM) within the candidate galaxy that contributes to strong lensing effects.
2. <u>SIS model</u>: approximates the lens candidate as a singular isothermal sphere, where the Einstein radius is proportional to the square of the velocity dispersion.

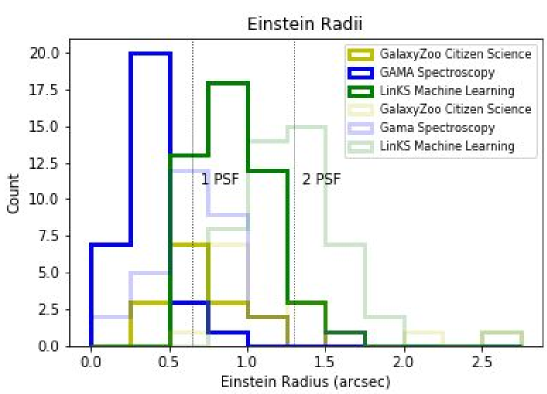
$$\theta_{\mathrm{E}} = 4\pi \left(\frac{\sigma_{\mathrm{SIS}}}{c} \right)^2 \frac{D_{ls}}{D_s},$$

In lieu of velocity dispersion measurements, we adopt a set of relations presented in Zahid+2016 fit to data from 375,000 galaxies from SDSS-DR12 and the Smithsonian Hectoscopic Lens Survey (SHELS). These relate central stellar velocity dispersions to total stellar mass of the objects, with separate coefficients for low and intermediate redshift ranges as well as a break in the intermediate mass range. Petrillo+2017 discusses Einstein radius estimates based on SIS models, noting that as a first approximation the stellar velocity dispersion can be substituted for the σ_{SIS} parameter, though through more rigorous calculations utilizing the Jeans equation they show it to result in slightly lower estimates than using the corrected σ_{SIS}. We estimate stellar velocity dispersions from the stellar mass of each candidate and calculate the Einstein radius from this velocity dispersion.

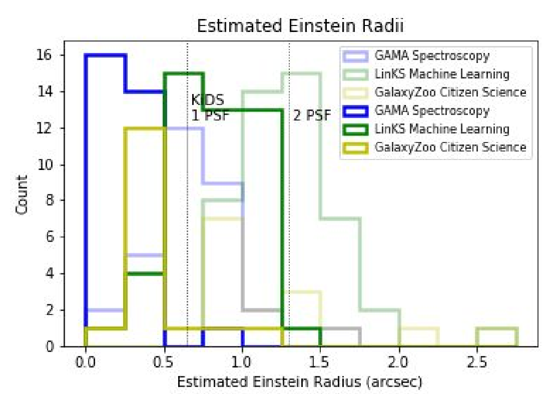
These estimates disagree to some extent, mostly in the low-redshift range because the point mass estimate is proportional to the inverse square root of the lens distance, a factor that is not present in the SIS equation. For this reason we present both as a range of probable values. At every mention of these estimates we submit both for comparison. Neither conversion changes our conclusion in any significant way.

We have critically re-examined the stellar mass estimates we use (there are three within GAMA). We now use stellar mass estimates converted from the GAMA LAMBDAR photometric catalog according to the prescription of Taylor+2011. This critical change was made because Einstein radius estimates described above produced unreasonably low estimates for many of the LinKS machine learning catalog, some well below the PSF of 0.65 arcsec.

Point Mass:

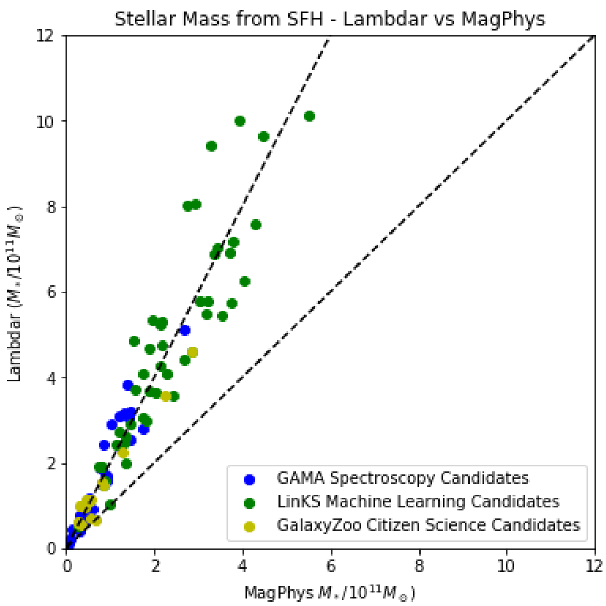


SIS:



In addition, Petrillo+2019 lists the distribution of parameters from which the simulated training set is constructed. These include Einstein radius values taken from a logarithmic distribution between 1.0 and 5.0 arcsec. For these estimates to peak at the PSF is highly unlikely. We assessed each step of the estimate searching for reasons why these estimates would result in such remarkably low values. The empirical fits are internally consistent and consistent with each other, as well as with two other fits we tried and did not report in the paper. These all consistently resulted in data like that shown above. The difference between σ_* and σ_{SIS} should only affect the velocity dispersion estimates, but we see the same trend in the point mass estimates.

This pointed us back to the initial stellar mass estimates taken from GAMA MAGPHYS catalog. The MAGPHYS code was run on the same photometric LAMBDAR photometric catalog as utilized by the LAMBDARmass Taylor+ (in prep). We found the LAMBDAR stellar mass catalog to be higher than the MAGPHYS stellar mass catalog by a factor ~ 2 for our candidates. The source of this discrepancy between the two catalogs (computed from the same photometry) is unknown to us and has not been previously highlighted. We believe the LAMBDAR estimates to be more accurate for ellipticals as MAGPHYS is primarily built for star-forming galaxies.



This factor 2 difference results in scaling of Einstein radius estimates by 2^c where c is the exponential dependence of the Einstein radius on M_* when converted through either the M_E or σ_* parameters (c < 1, c ~ 0.6). It also results in a shift in logarithmic space that retains the relationships shown in Figure 10 while moving them to higher masses. These higher masses do affect our conclusions to a small extent, because the lower-mass candidates are now closer to the expected mass range of SLACS-like candidates. We adjust our language where appropriate to reassess based on the data we are using.

>>> 2. The computation of M_{fr, *} is presumably wrong. Again, converting from the dark-matter fraction within r_e/2 to the stellar mass within 1"-radius circle (or ellipse) is non-trivial and requires some knowledge of the light distribution. What did the authors use? The lens distance-stellar mass relation on Page 19 suggests that the authors did this conversion (and likely the Einstein radius estimation) incorrectly.

<<< Thank you for bringing this to our attention. We have critically re-examined our stellar masses, Einstein radius estimates, and everything reliant upon those estimates. The fiber radius mass has been redefined to represent the total stellar mass that contributes to an Einstein radius equal to 1 arcsec given a set ratio of lens to source distance, converted through the relations of M_E and σ_* described above. We set the Einstein radius equation equal to zero and solve for the remaining parameters. This results in a relation for point mass estimates between lens redshift and total stellar mass, shown as curves with specified source to lens distance ratios. For SIS estimates, which do not have an explicit dependence on lens distance for a specified lens to source distance ratio, this results in vertical lines of fixed total stellar mass for the redshift ranges described in the Zahid+2016 relation. These fiber radius masses are total stellar masses that fall along the curves and result in 1-arcsec Einstein radii. As such they represent a meaningful comparison to the total stellar masses of candidates.

Other comments:

Introduction
"constraining their Fundamental Plane" - I still don't agree that lensing "constrains" the FP, although it does constrain the total mass to light ratio. Essentially, the FP only involves size, surface brightness, and velocity dispersion, none of which necessarily requires lensing. I think it'd be better to say lensing constrains the mass plane or lensing helps to better understand the FP, as shown in Bolton+ (2008).

<<< We have changed the phrasing to “helps to understand”.

Section 3.3
"as a point-mass system" contradicts with "We emphasize that M does not denote the total mass of the galaxy but only the mass enclosed". The point-mass assumption can actually be dropped because the author's expression for the Einstein radius is valid for a thin lens with an arbitrary mass distribution.

<<< We have re-examined our Einstein radius estimates and present those above. The derivation of this point mass expression assumes a surface density described by a Dirac delta function in the calculation of the projected potential for use in the thin lens equation. We maintain the point-mass terminology to distinguish it from the SIS model that accounts for a more complex distribution of mass.

"73 SLACS candidates" -> 73 SLACS lenses

<<< This has been addressed.

"several candidates" at two places - "several" is inappropriate given that at least 30 out of 108 candidates (according to Figure 9, which also has some potential problem. See below) are less massive than 10^11 solar masses.

<<< This has been addressed.

Figure 9
There appears to be less than 47 blue circles in Figure 9 and Figure 13. The redshift histogram in Figure 9 suggests ~10 z > 0.5 GAMA spectroscopy lens candidates, while only one is seen in the scatter plot. Those high-z ones are gone from the histogram in Figure 13. Please check these figures and all the other figures!

<<< We note now in the paper that some of our sources have unreliable stellar mass values (16 GAMA spectroscopy and one LiNKS source). We have clarified this in the text and plots.

Figure 10
Might be worth using different symbols here as the colors become similar towards the low score end.

<<< We thank the referee for this suggestion. The markers are now squares and diamonds.

Section 5
>>> How large is this empirical factor? I would think it to be larger than 1.

<<< Petrillo et al do not state what their adopted factor is. We adopt 1 as the minimum value.

>>> Why this factor is not considered when making the LRG parent sample? The authors said effective radii in ugriz bands are used. However, 1) KiDS doesn't have z band; 2) Petrillo+ (2017) only applied this selection to the r-band size.

<<< Because this factor was not reported in Petrillo+. We adopt 1 as the minimum value. We thank the referee for pointing out the lack of clarity in reporting the source of effective radius data. We used r-band effective radii.The mention of ugriz was only meant to describe the catalog from which we obtained the r-band size.

>>> The KS test on the GAMA spectroscopy sample suggests some deviation in redshift from the LRG parent sample that the author constructed. To what degree is the detected redshift deviation related to not including this empirical factor in making the LRG parent sample? For example, if this empirical factor is generally larger than 1, then considering it in the lens candidate sample but not the LRG parent sample could bias the lens candidate sample against high redshifts.

<<< The GAMA spectroscopy sample was not targeting an LRG sample but selected spectra that were best described with a passive stellar template.

Section 6.2 and Figure 13

>>> It's not fair to compare M_{fr, *}, even if it's computed correctly, to the "total" stellar mass of the other two samples as done in Figure 13. Say for a circular de Vaucouleurs profile with an effective radius of 2", the stellar mass within 1"-radius circle is smaller than the total mass by ~0.5 dex, which can explain almost all "stellar mass excesses" seen in Figure 13.

<<< This has been addressed in the above discussion of Einstein radius estimates and fiber radius masses.

>>> "The precise fraction of total stellar mass that contributes to lensing in each case is unknown, ..." - I think one should be able to get some reasonable estimate on the stellar mass within a certain radius given the Sersic index and effective radius (presumably from SersicPhotometry catalog) in a red band (say r or i band).

<<< Since we no longer estimate dark matter fractions, as discussed above, this is no longer an issue.

>>> I've checked that the cumulative exposure time in F625W for G593852 is 4000s, so it's not shallow at all. And F625W is a wide filter that roughly corresponds to SDSS r band. By looking at the HST F625W image that I downloaded, I personally think the fuzzy features around the central galaxy are likely related to interactions instead of lensing. Can the authors comment more on this system in the manuscript?

<<< We are trying to avoid value judgements on single candidates. Visual inspection and classification by individuals is noisy at best. Commenting on individual systems is out of the scope of our paper. We have not included more postage stamps of the lenses because the scope of the paper is to focus on the selection process.

The authors wish to express once more our sincere appreciation for the time and consideration of this manuscript. We wish you the best in these unprecedented times.

With highest regards,

Shawn Knabel