Uncertainties driven by ICL and bCGs

All of the previous error analysis and source measurements are performed in the processed image, which is obtained by subtracting the ICL and bCGs from the original image. As previously described, a series of steps are carried out to obtain the final measurement image. We begin by removing the ICL. In this step we remind the reader that we applied a median filter technique to map the light distribution of ICL after masking real sources, during which we chose a filtering kernel size of r_{out}=105 pixels. As a caveat, this method is r_{out}-dependent. This means that varying the kernel sizes would result in marginally different ICL maps (i.e., filtered background), but the main large-scale patterns/gradients are virtually unchanged. For SExtractor measurement in the final processed image, we have demonstrated that this is not a problem in terms of source magnitude and size. This is to be expected, because the operating kernel size r_{out} is chosen to be large enough to not influence the real sources. Moreover, we have masked all the sources during the filtering processes. Such effects on GalfitM measurements of the processed image however remains unknown. For instance, it is natural to point out that low surface brightness, extended objects are more sensitive to the choice of kernel sizes, and the measurements may potentially be biased. It is essential to ascertain whether the choices of different kernel sizes will affect the Sérsic fitting results. Therefore, for single Sérsic fitting, the last error component in HFF is driven by the methodology of subtracting ICL (and ensuing bCGs).

We statistically quantify this uncertainty based on a bootstrapping method. Starting from original frame we repeatedly run the pipeline to create a collection of processed frames, with each one using different filtering kernel sizes. In this whole workflow, the kernel size r_{out} is the only variable, while the rest of steps follow the same setups as adopted before. The r_{out} is evenly chosen in steps of 2 pixels within a range of 105-170 pixels, resulting in 33 frames in our processed dataset. Figure 1 shows ten ICL maps derived using different r_{out}, which will be subtracted from the original image. Once the dataset (i.e., ICL- and bCG-subtracted images) is build, we proceed to separately (in parallel) perform the catalog analysis on these image products with the same configuration parameters as used before. In this analysis, each object is measured 33 times under the background perturbations of various levels. For each parameter the standard deviation of the distribution is taken as the uncertainties. Table 1 presents parameter uncertainties introduced by the various of choices in subtracting ICL, where one can clearly see that the derived uncertainties are quite small. This demonstrates that our methods are not affected by this error component.

References

Table 1: Uncertainties of the Sérsic parameters for the real sources, driven by the ICL subtraction.

id	mag_err (mag)	re_err (pixels)	n_err	q_err	pa_err (degree)
1	0.0005	0.0021	0.0005	0.0	0.003
2	0.0508	0.0993	0.0682	0.0297	85.7372
3	0.0043	0.0017	0.088	0.018	0.3244
4	0.0112	0.0231	0.0144	0.0021	0.0965
5	0.0519	0.2758	0.1317	0.0056	1.1411
6	0.0207	0.0412	0.0303	0.0126	0.1452
7	0.0032	0.0024	0.0166	0.0035	0.1191
8	0.0051	0.0191	0.0068	0.0007	0.0376
9	0.0027	0.0238	0.0201	0.0001	0.007
10	0.0009	0.001	0.0274	0.0015	0.1483
⋮	⋮	⋮	⋮	⋮	⋮

Notes. Column 1: ID number of the source in the catalog. Column 2: magnitude uncertainties. Column 3: half-light radius uncertainties. Column 4: Sérsic index uncertainties. Column 5: axis ratio uncertainties. Column 6: position angle uncertainties.

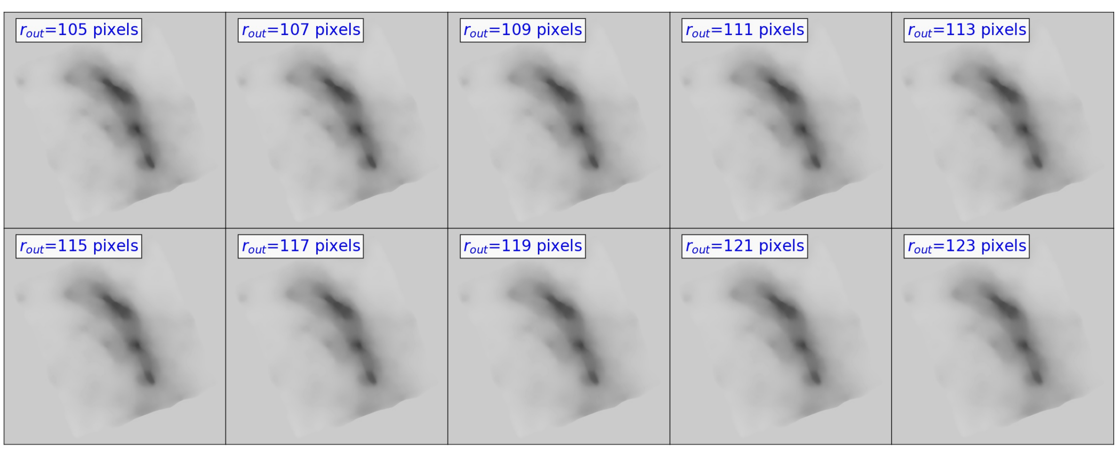

Figure 1: An example of ten ICL maps derived with different r_{out}, as indicated in the legends.