

Machine learning based star spectral classification

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1st year PHD

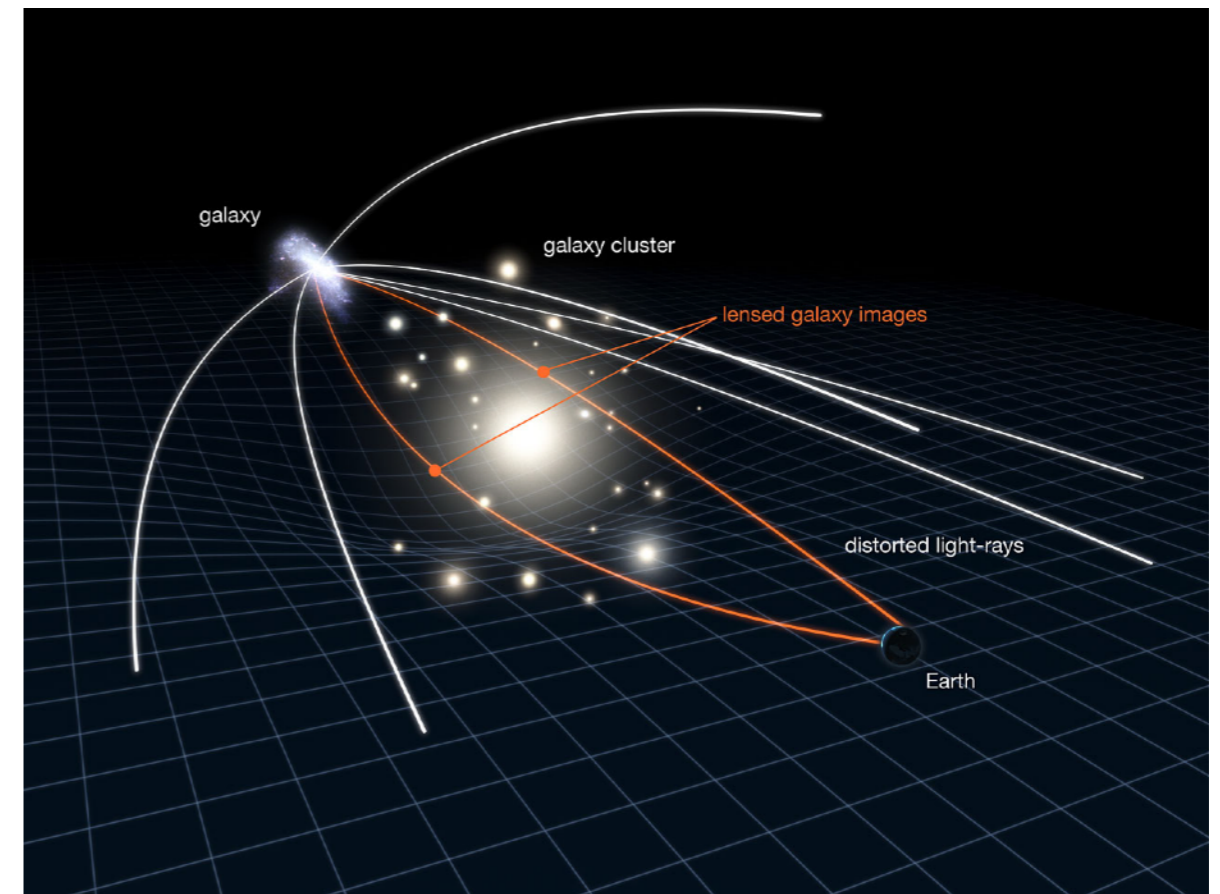
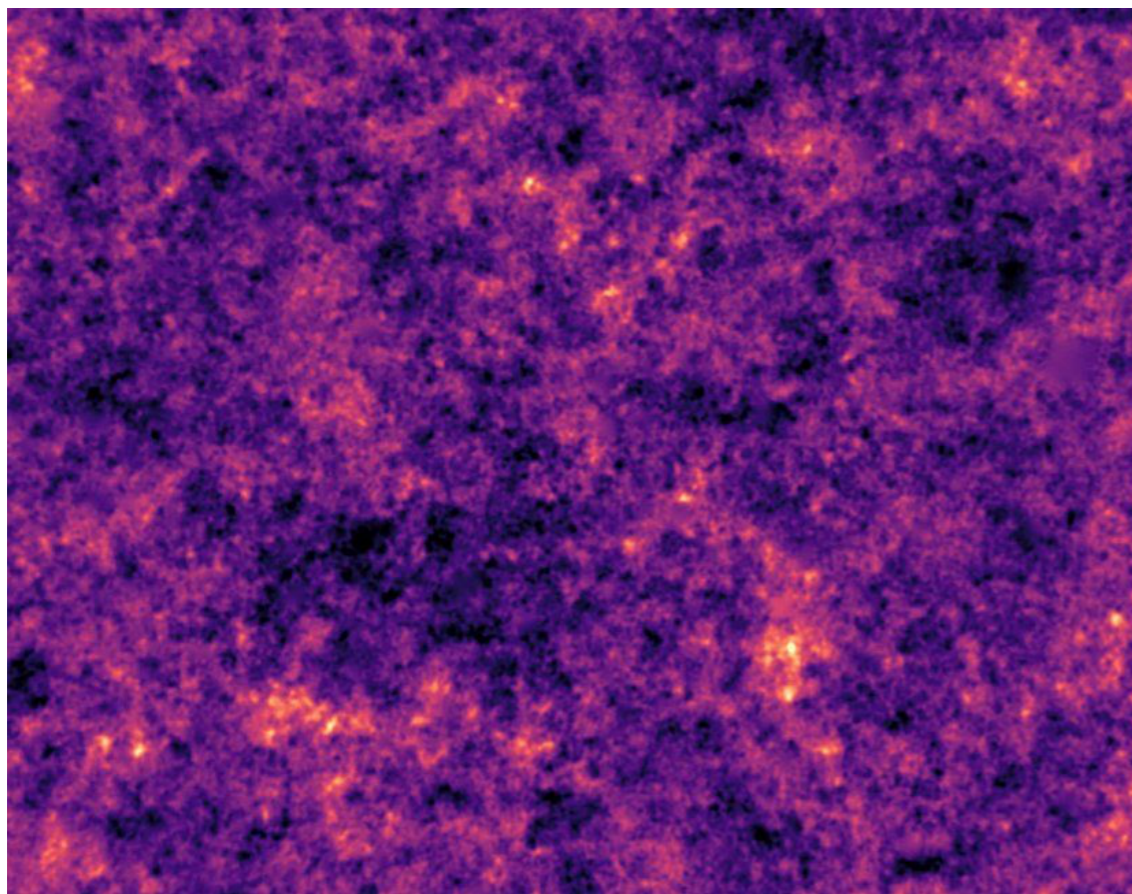


Outline

1. Context
2. Point spread function (PSF)
3. PSF modelling: WaveDiff
4. Star spectral classification
5. Preliminary results
6. Conclusion

Λ -Cold Dark Matter

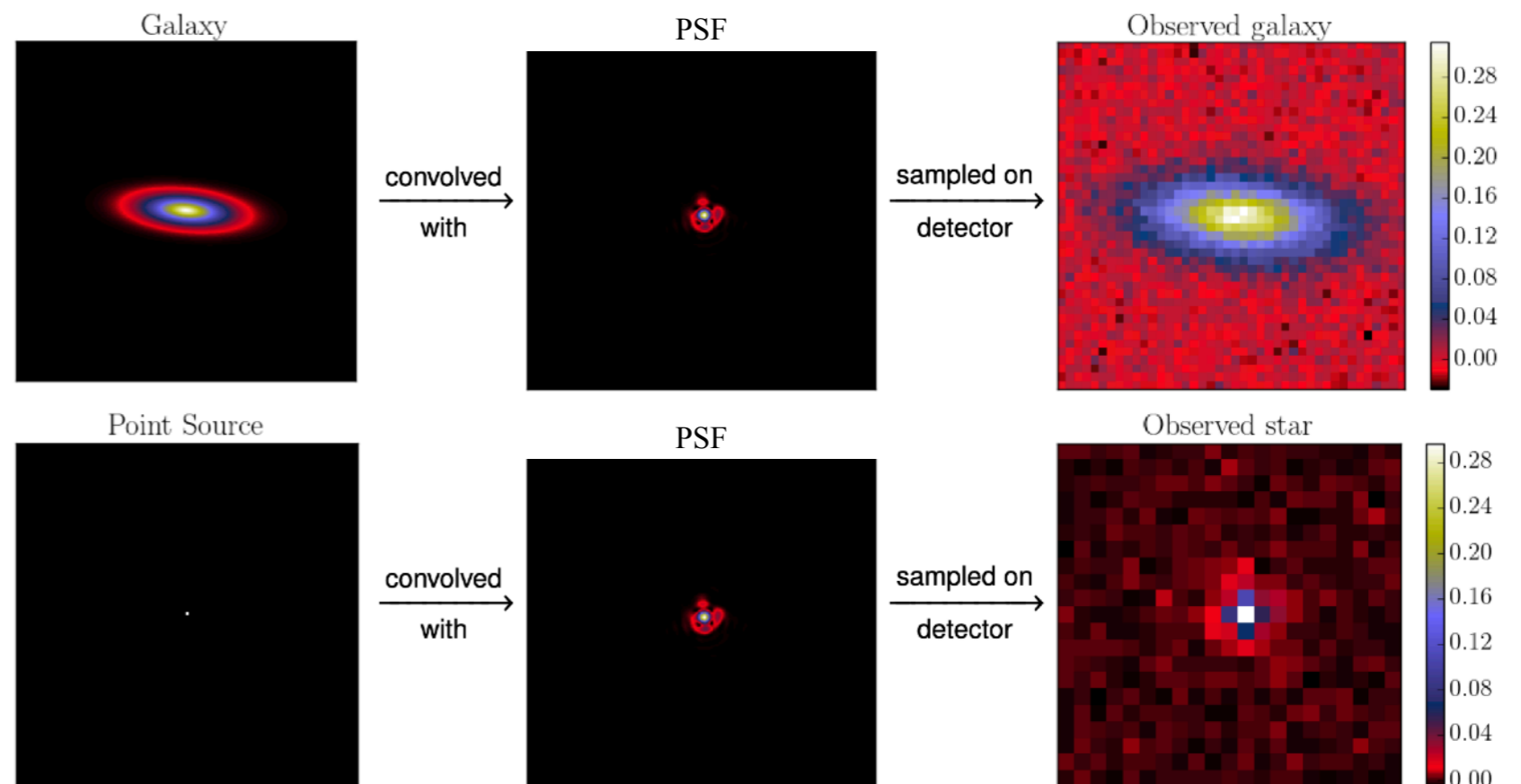
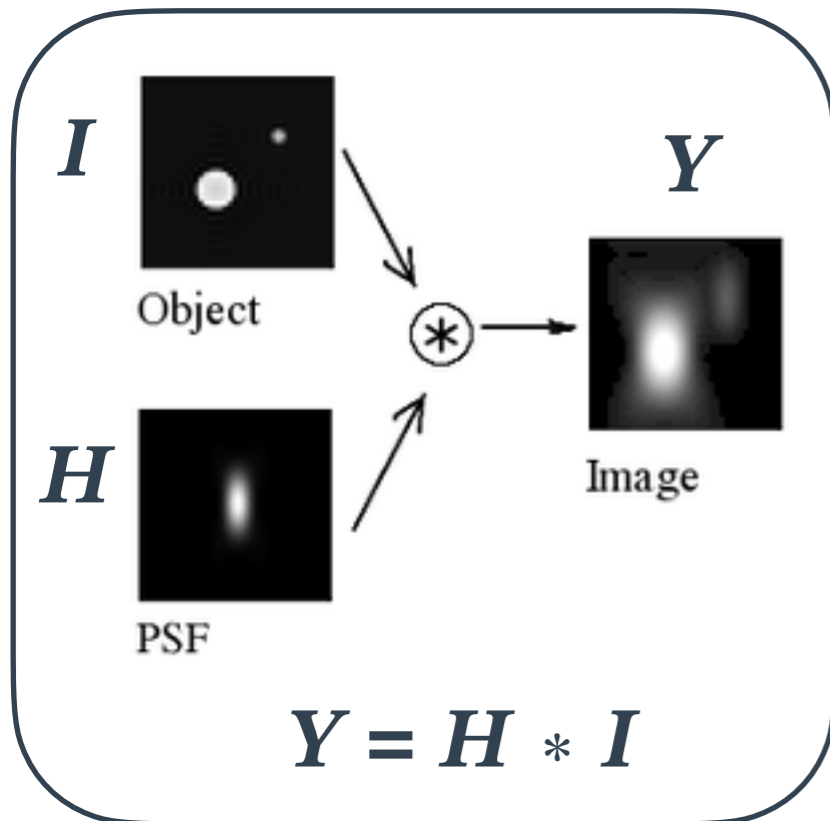
Gravitational Lensing



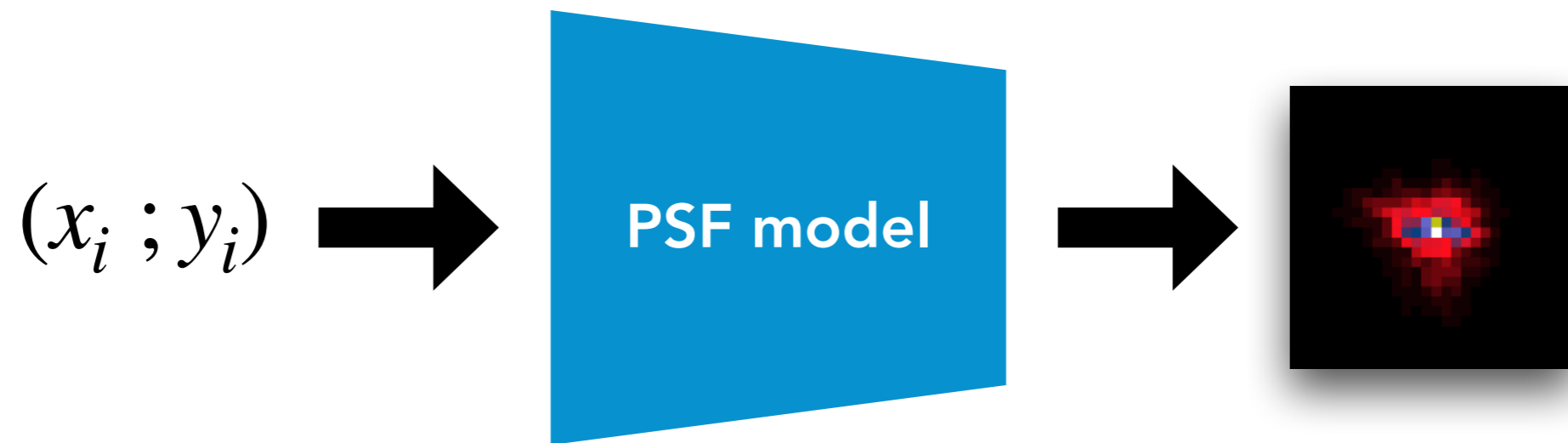
Credit: V. Springel et al. 2005

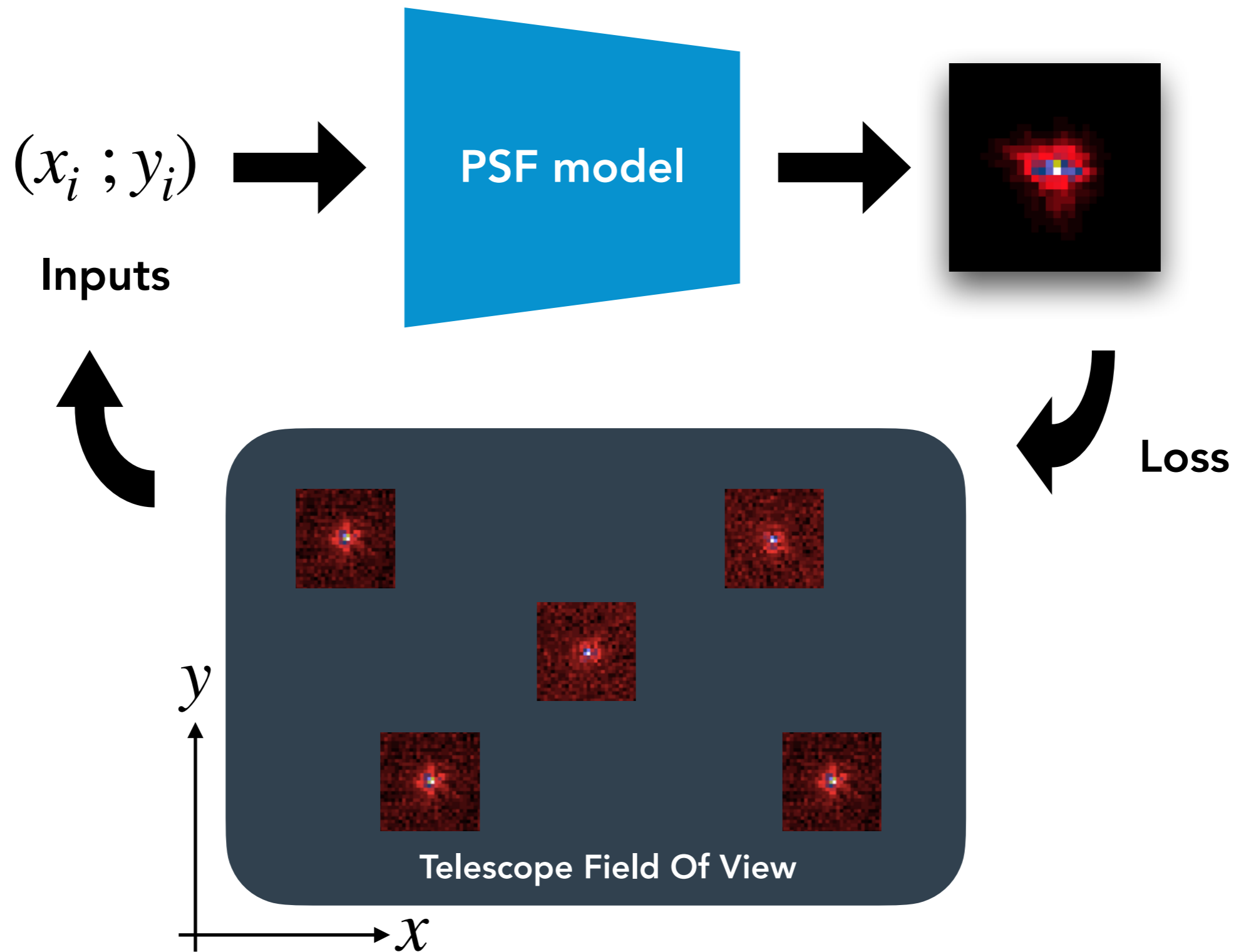
Credit: NASA, ESA, L. Calsada.

Point Spread Function - PSF

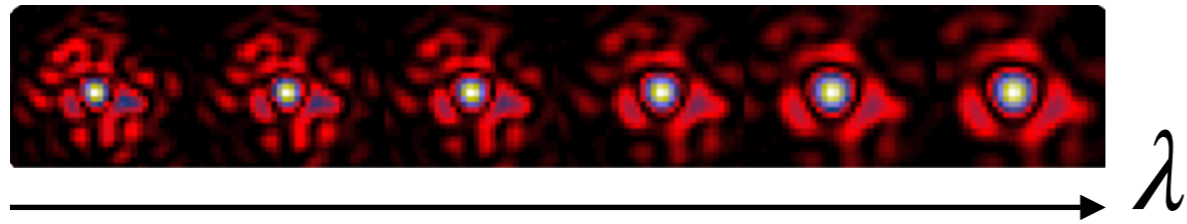


Credit: Morgan A. Schmitz

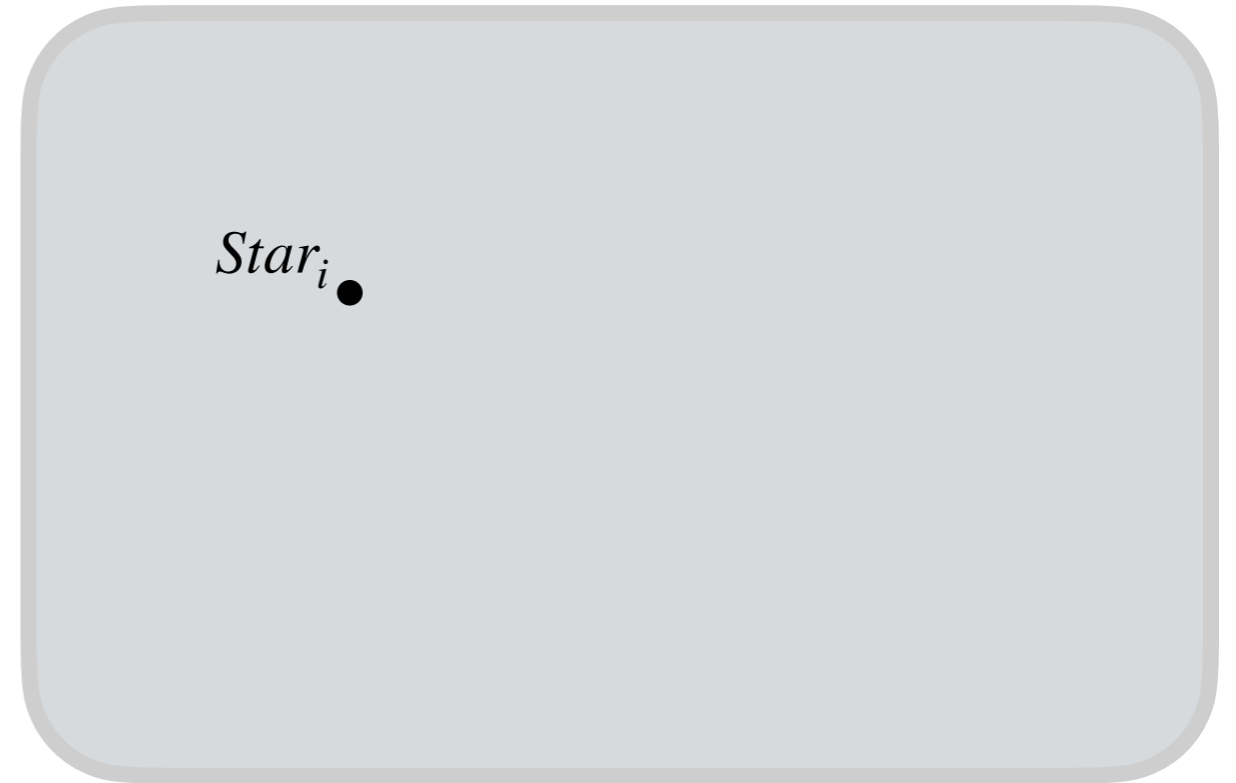
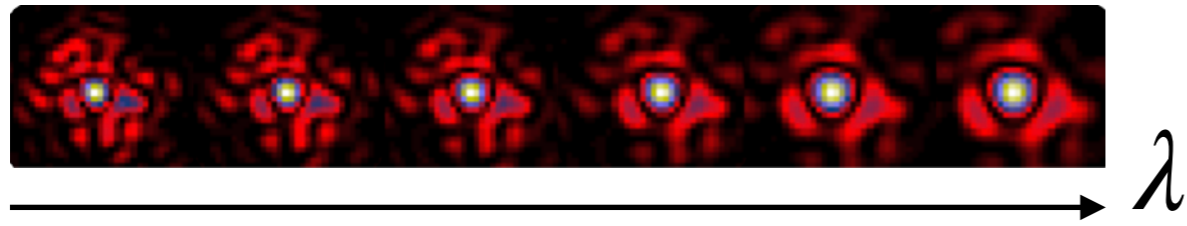




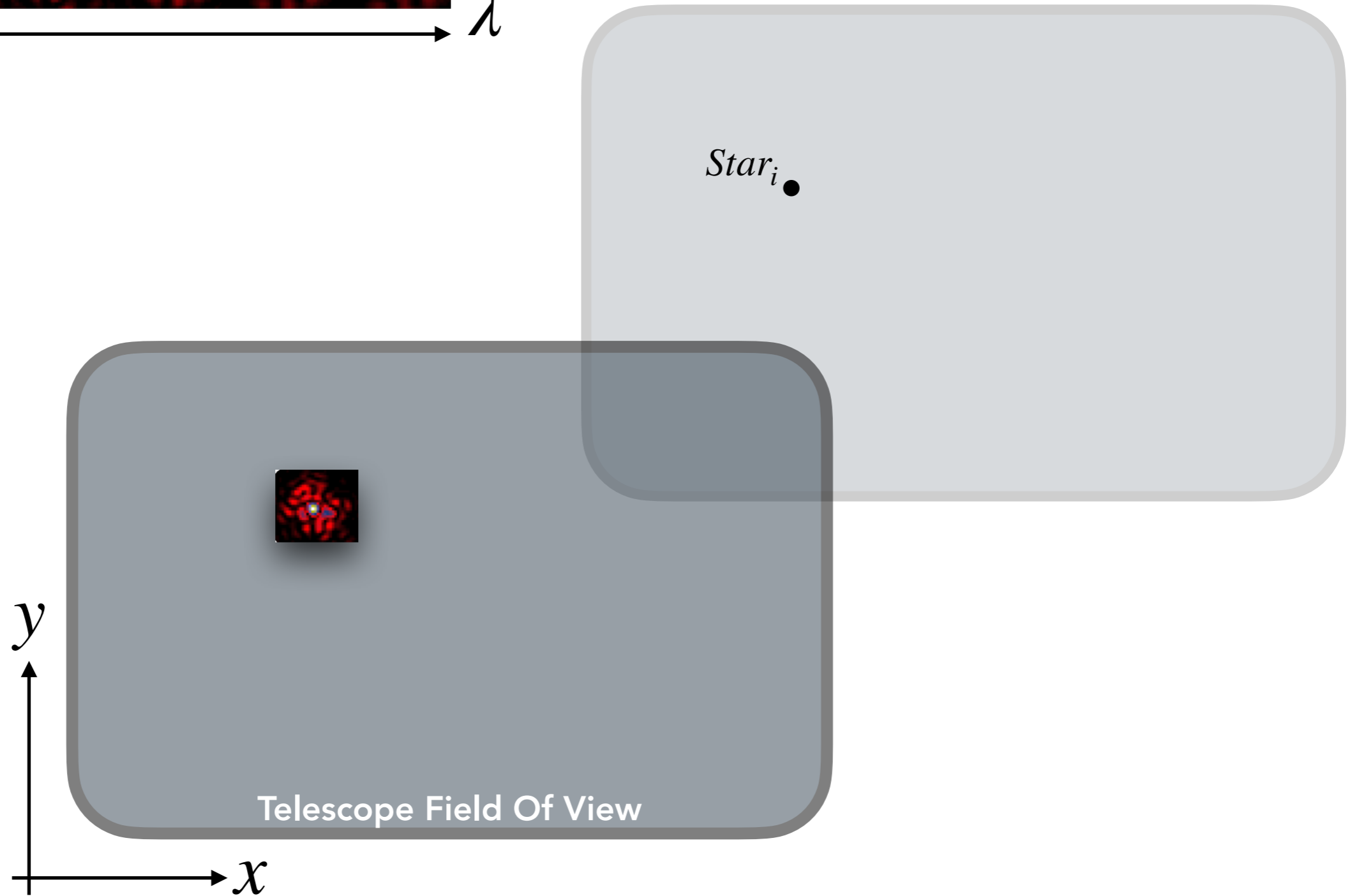
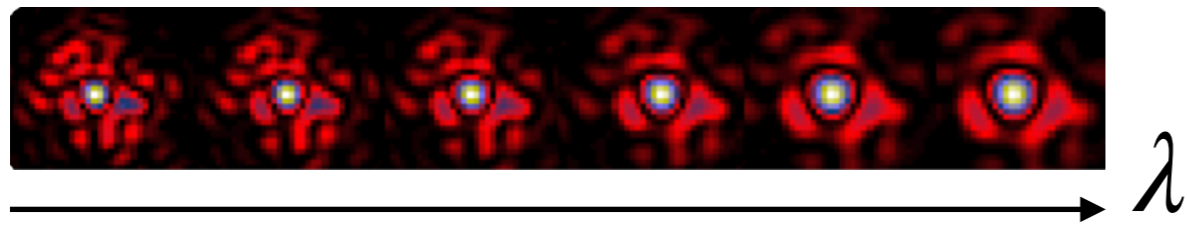
$PSF(\lambda)$

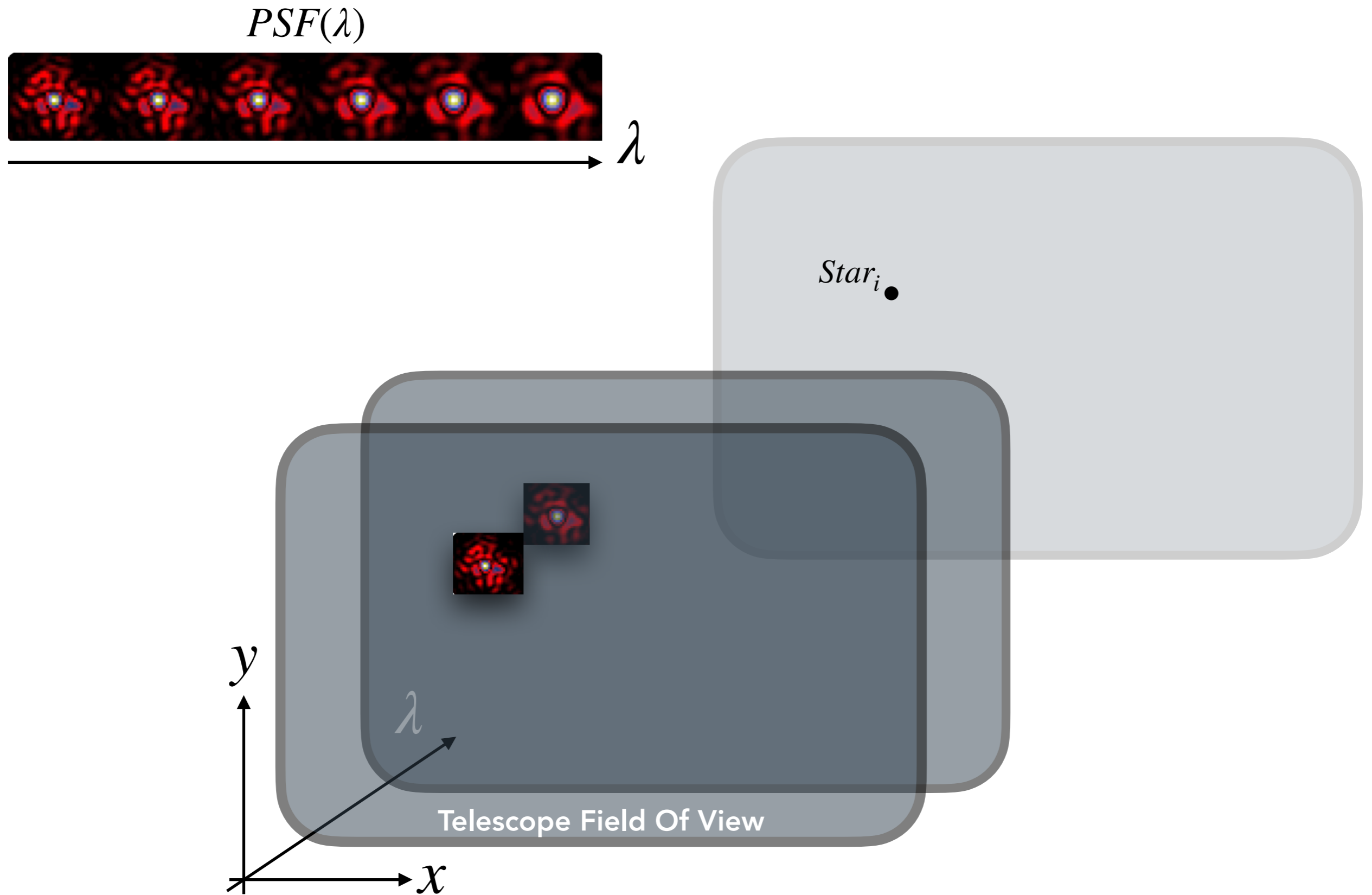


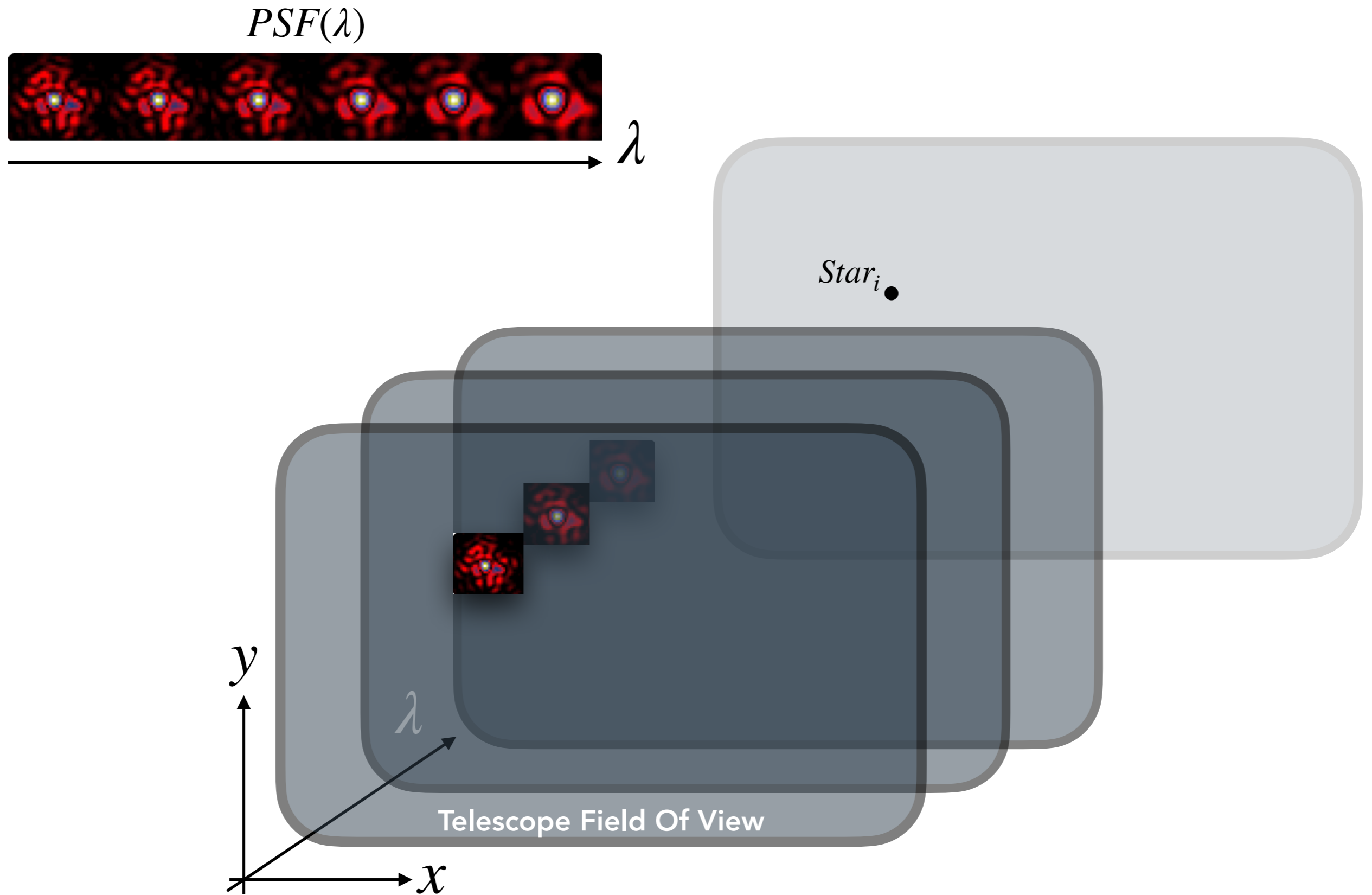
$PSF(\lambda)$



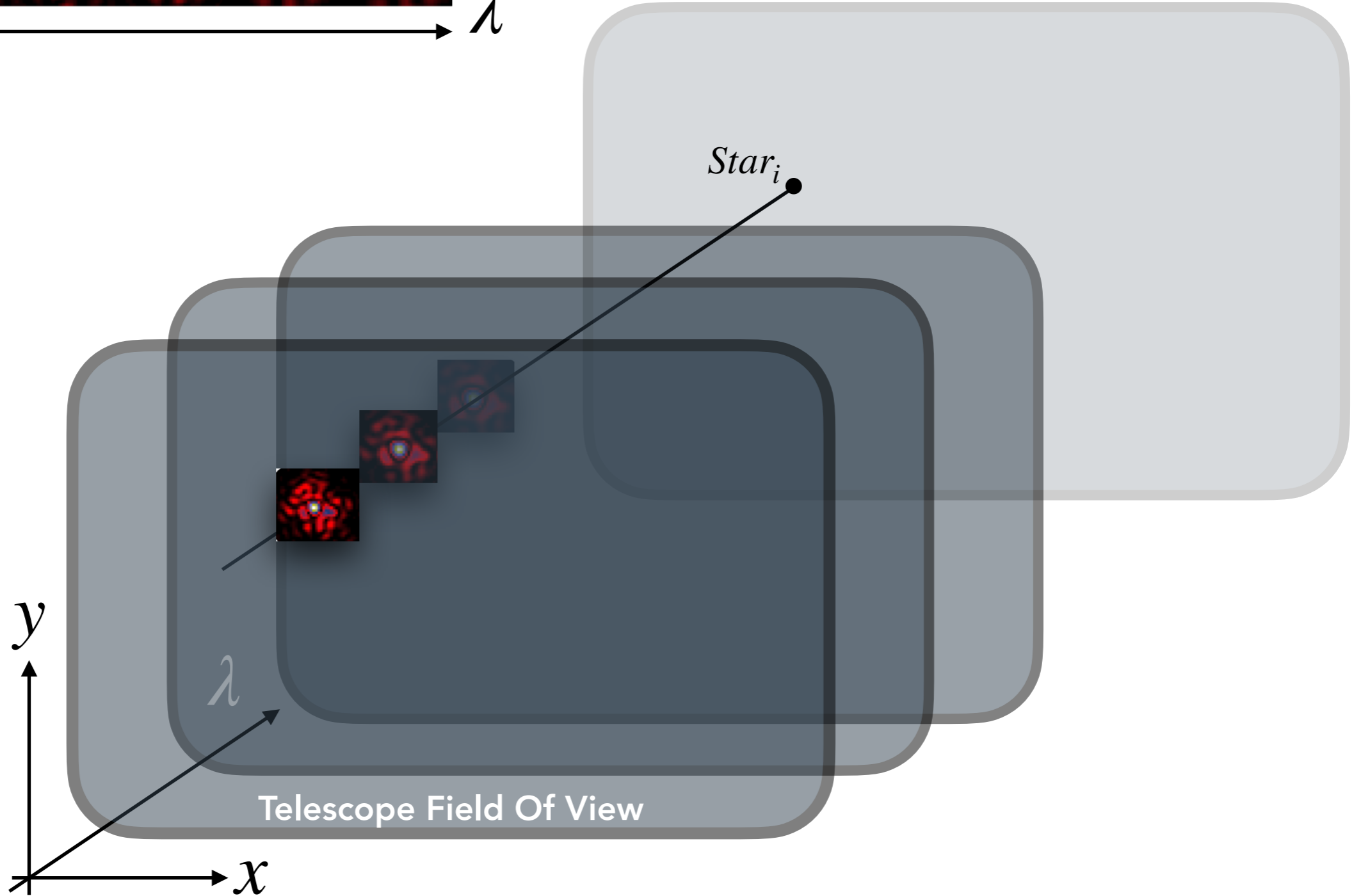
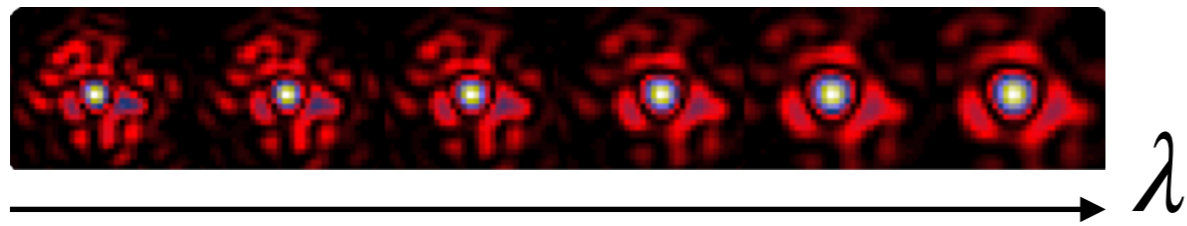
$PSF(\lambda)$

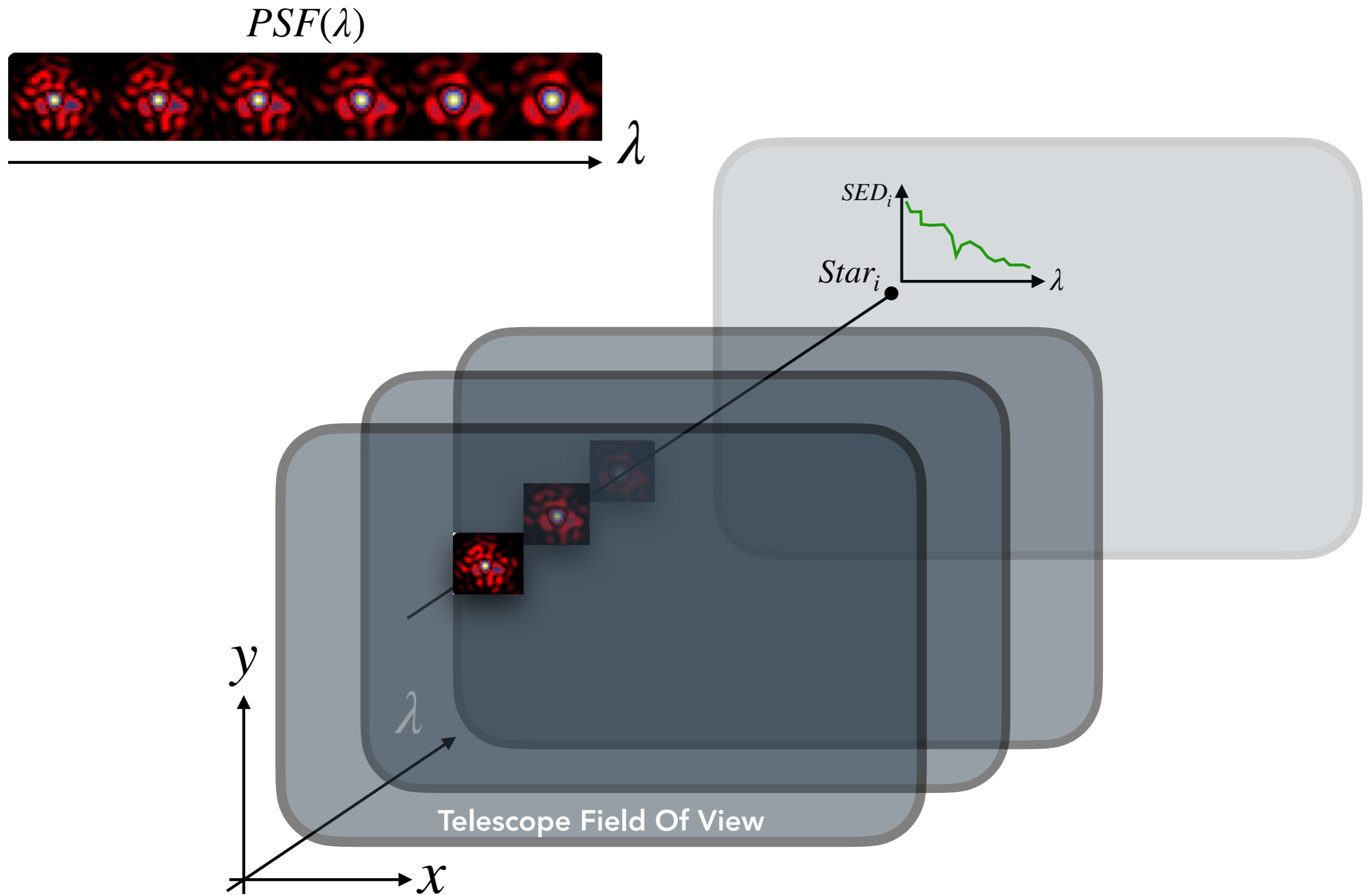


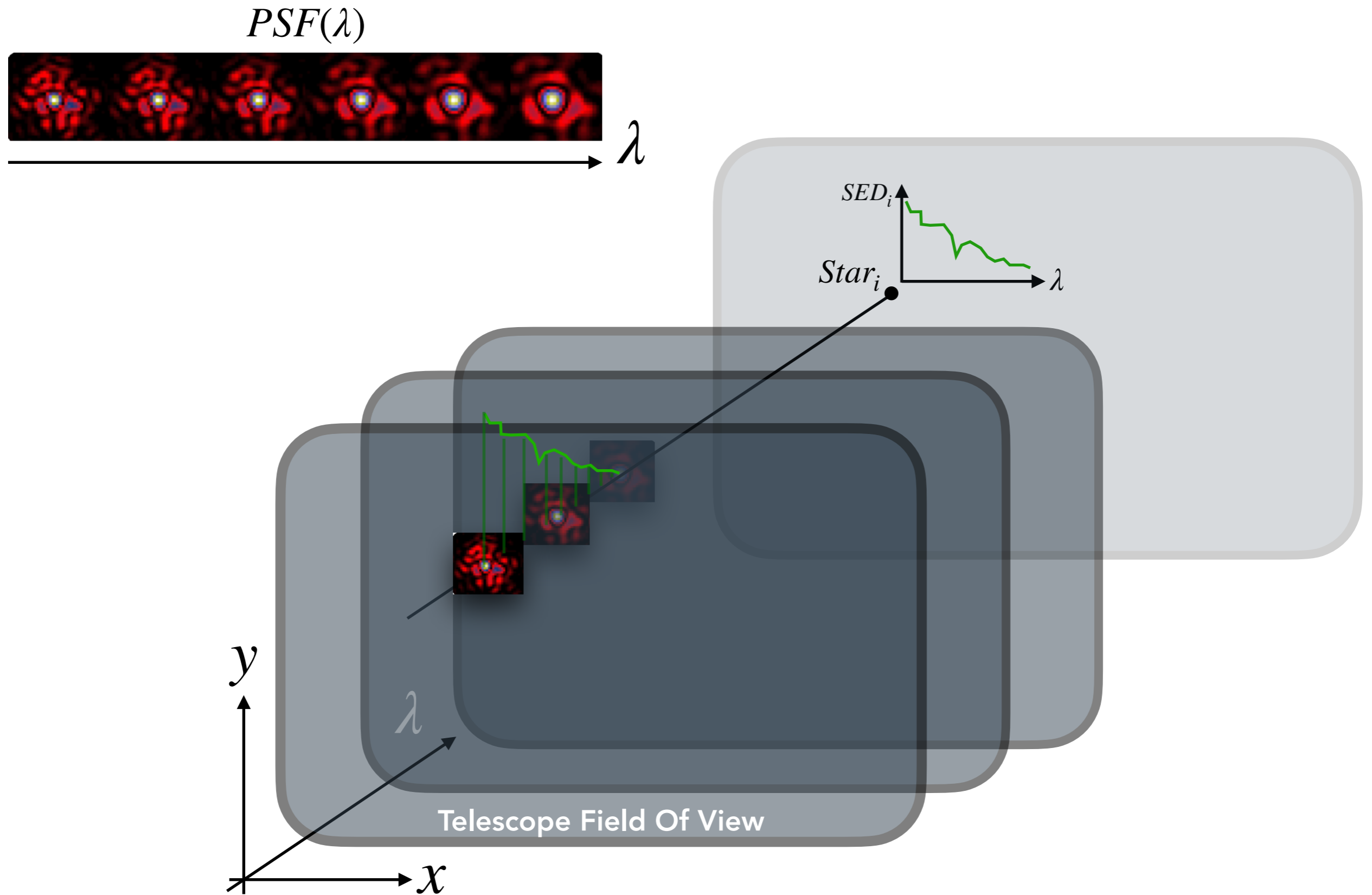


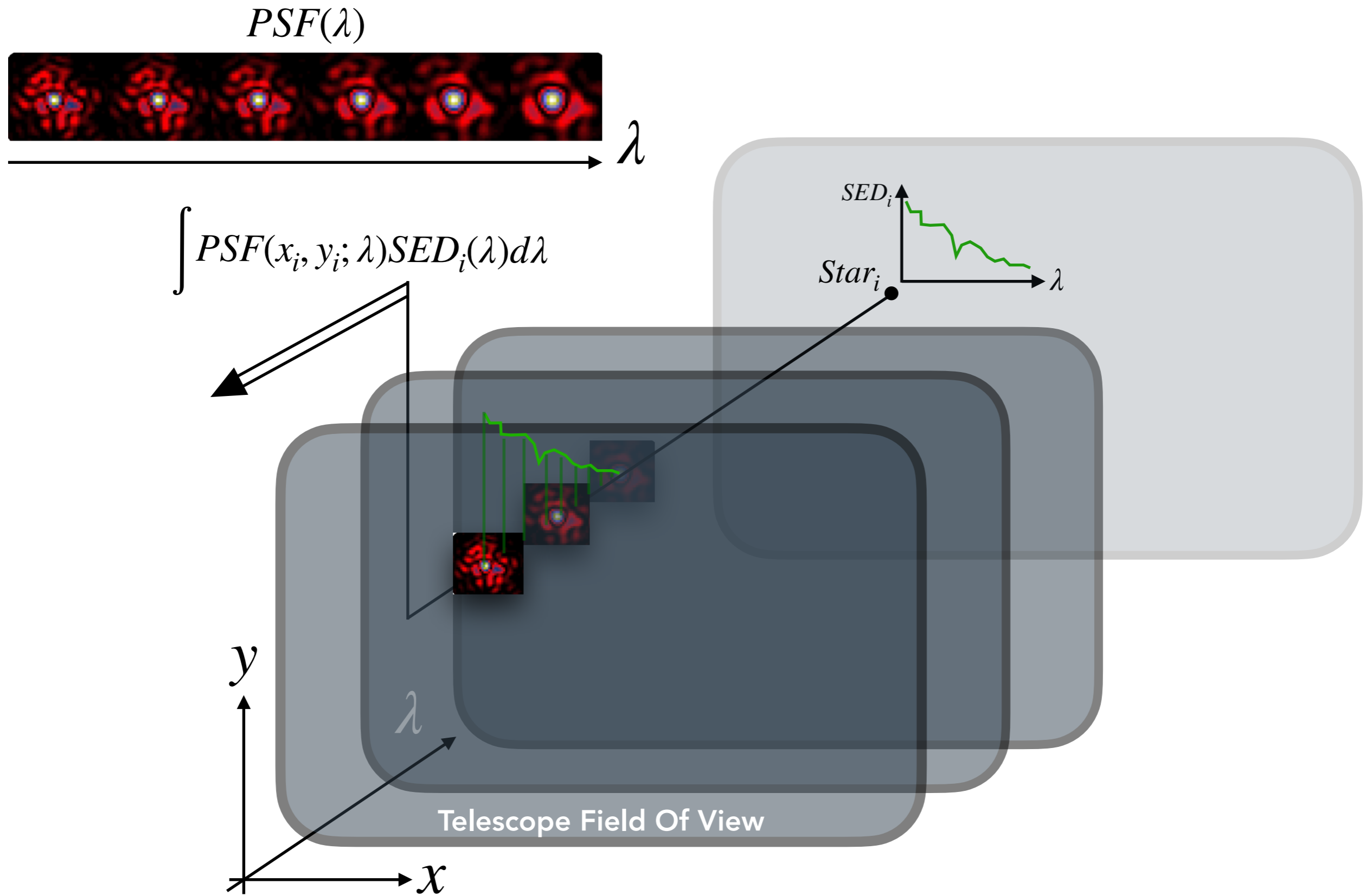


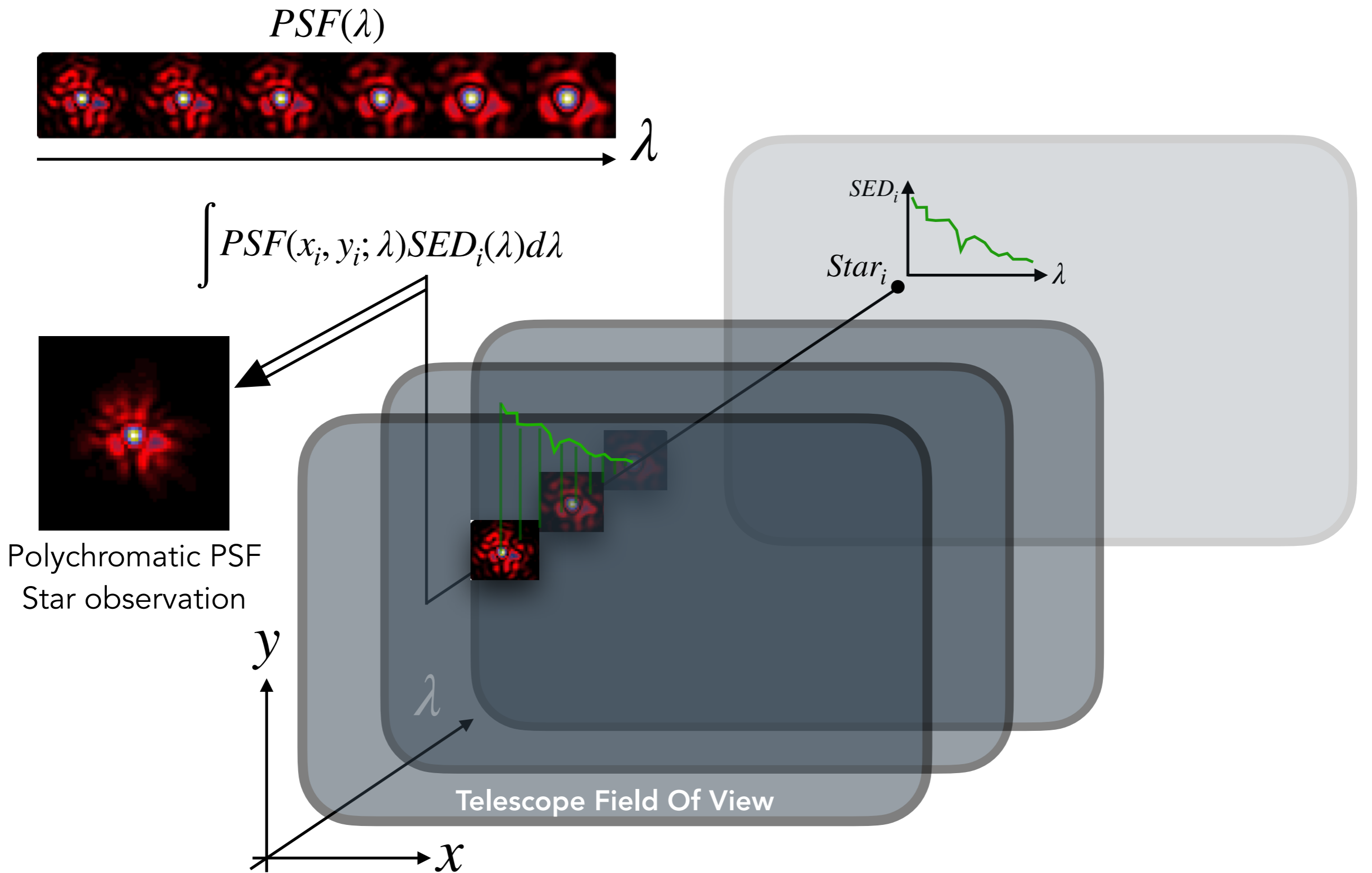
$PSF(\lambda)$

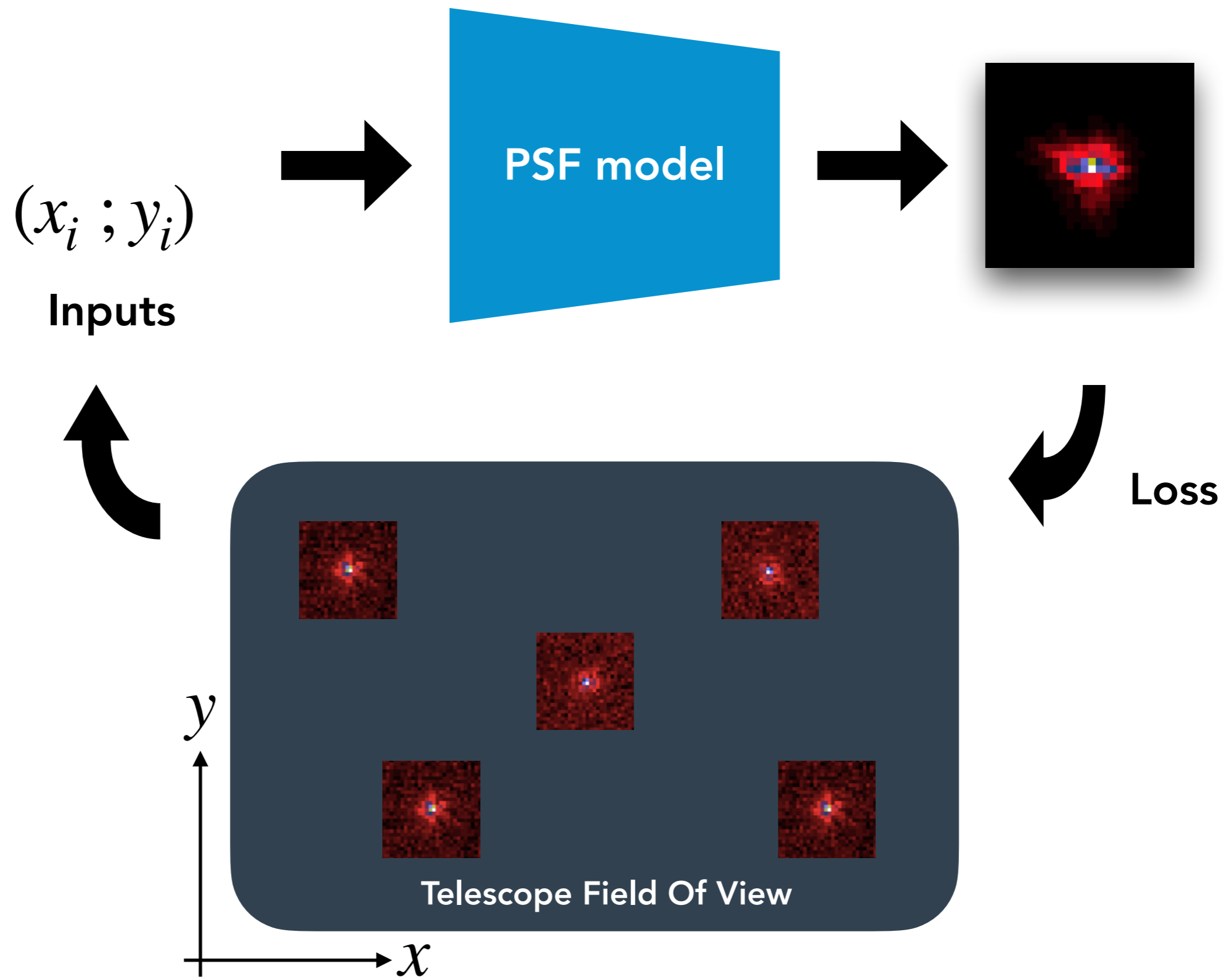


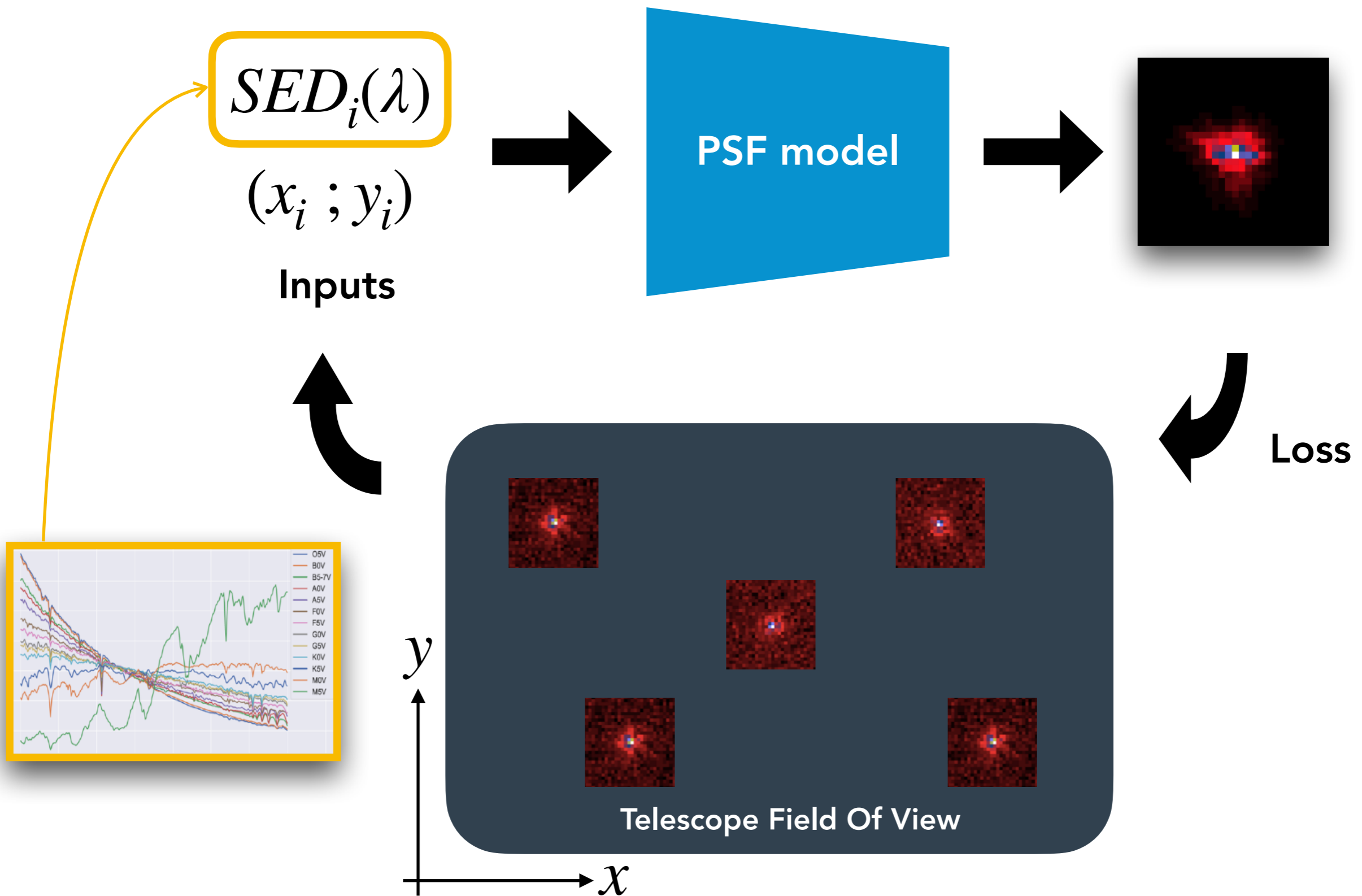




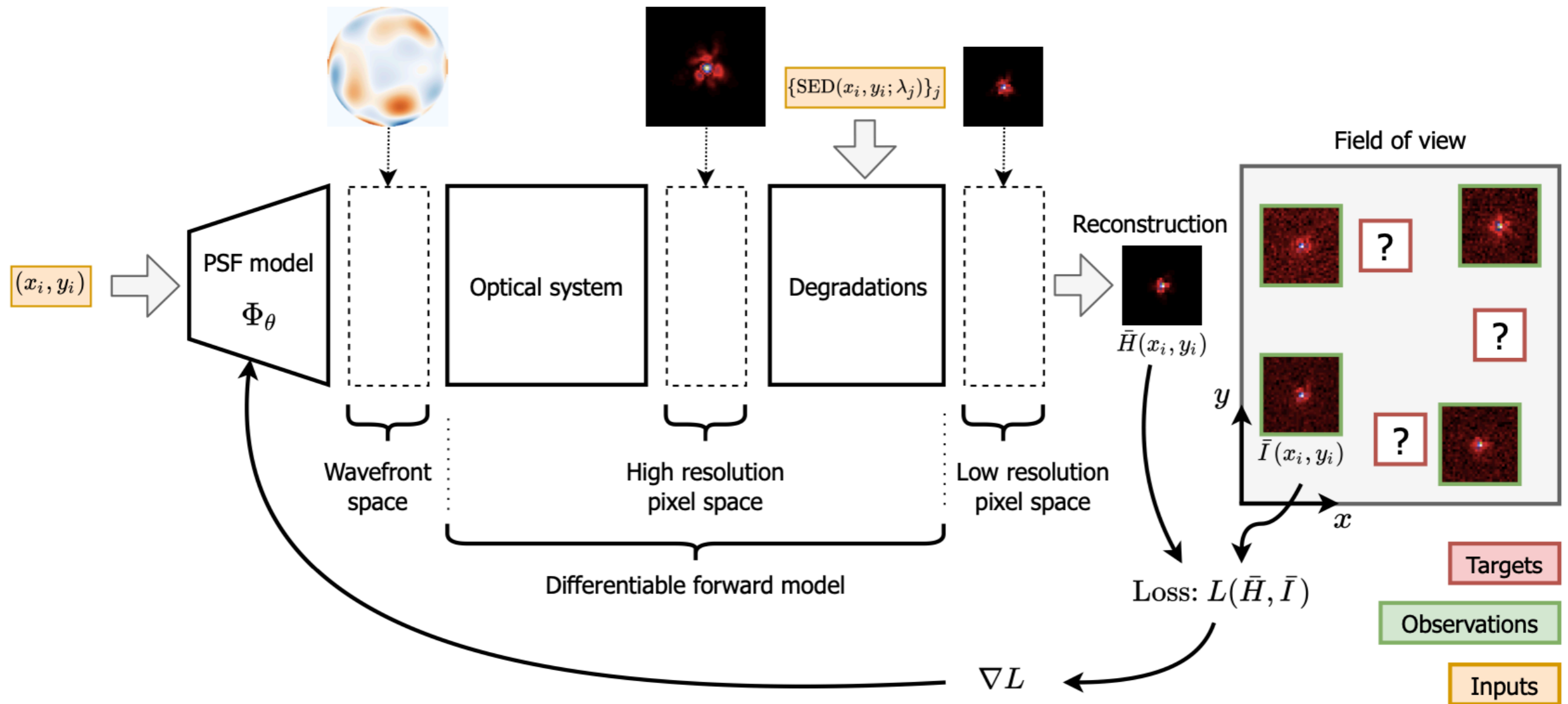




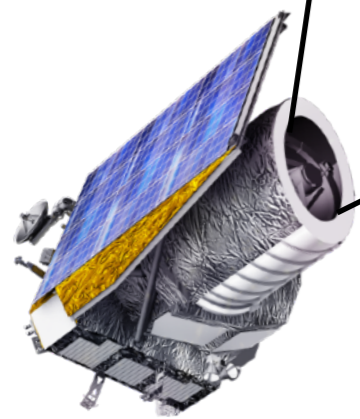
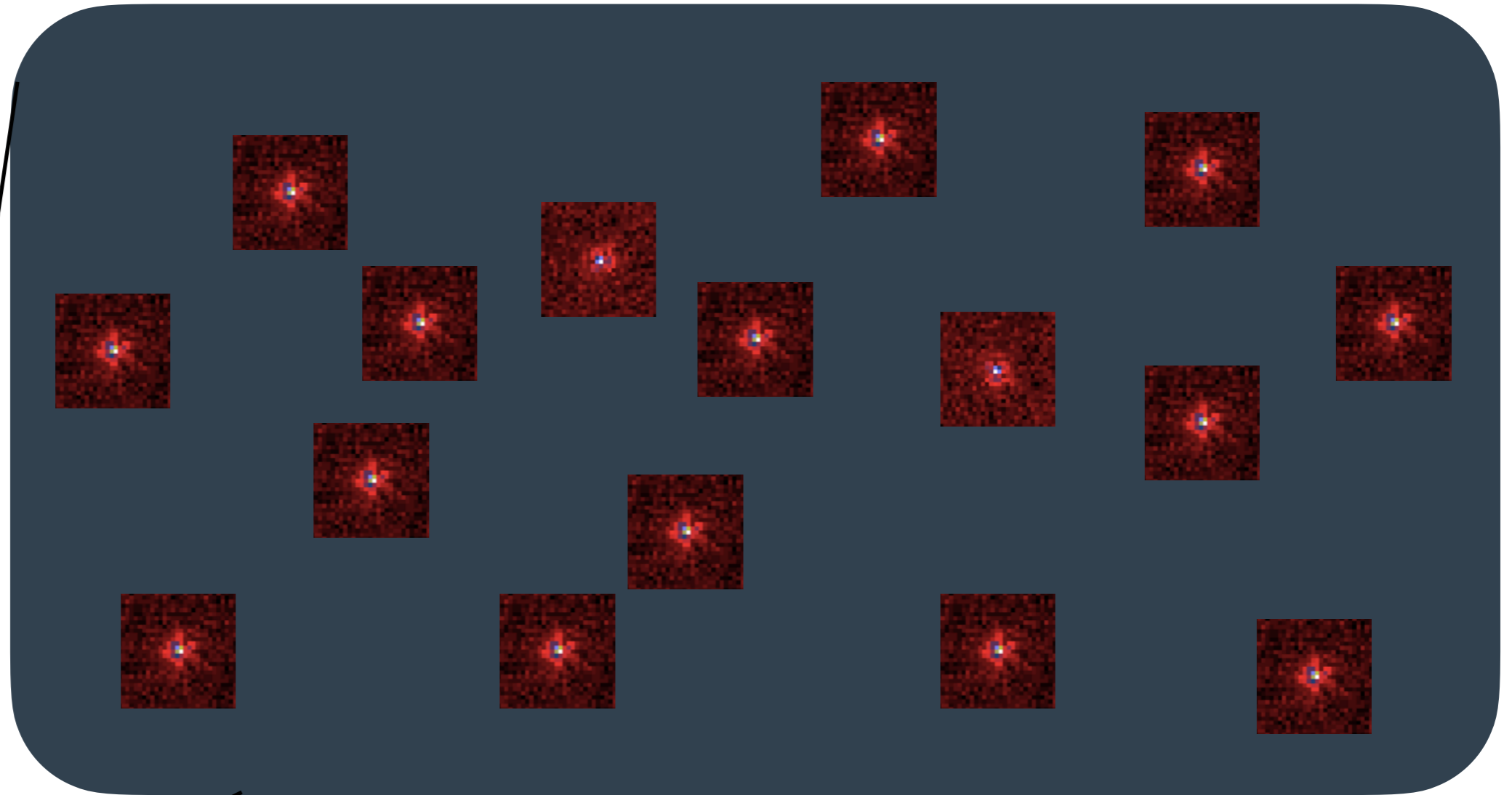


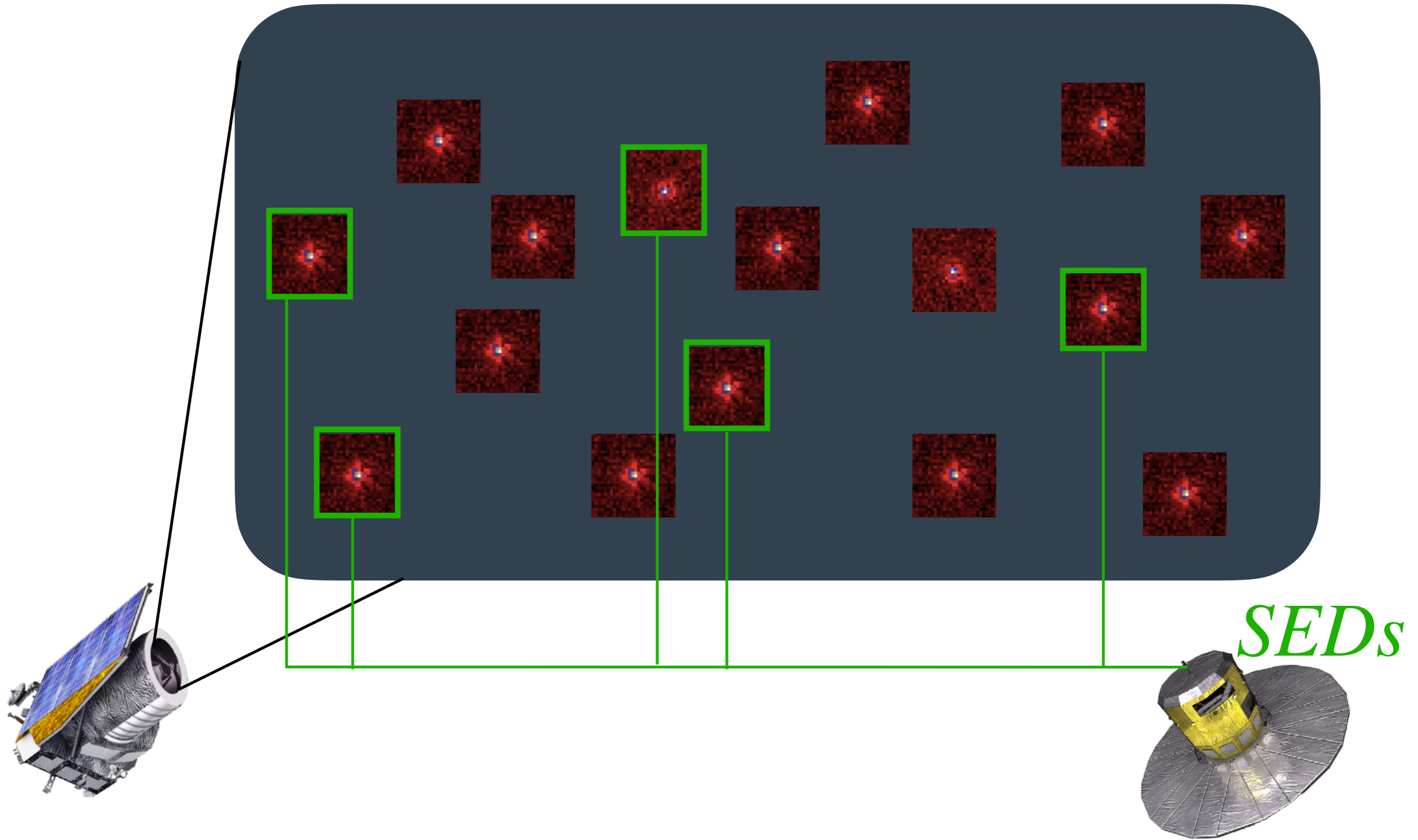


WaveDiff: fully differentiable data-based PSF model

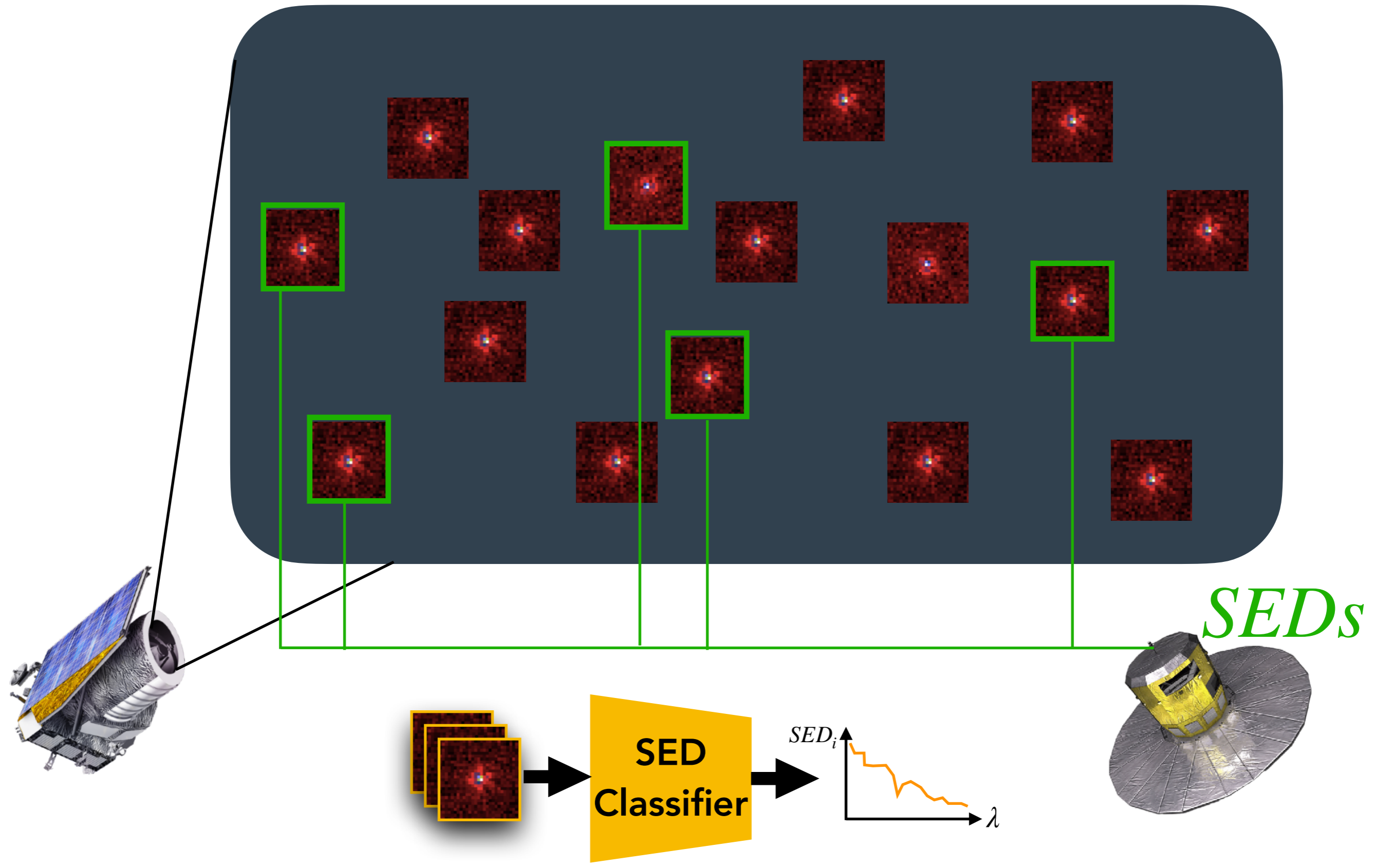


Credit: Liaudat, T., Starck, J.-L., Kilbinger, M., and Frugier, P.-A



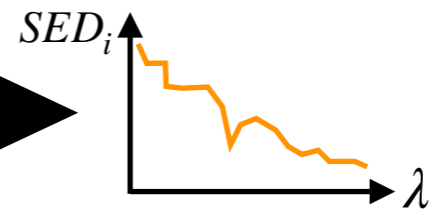


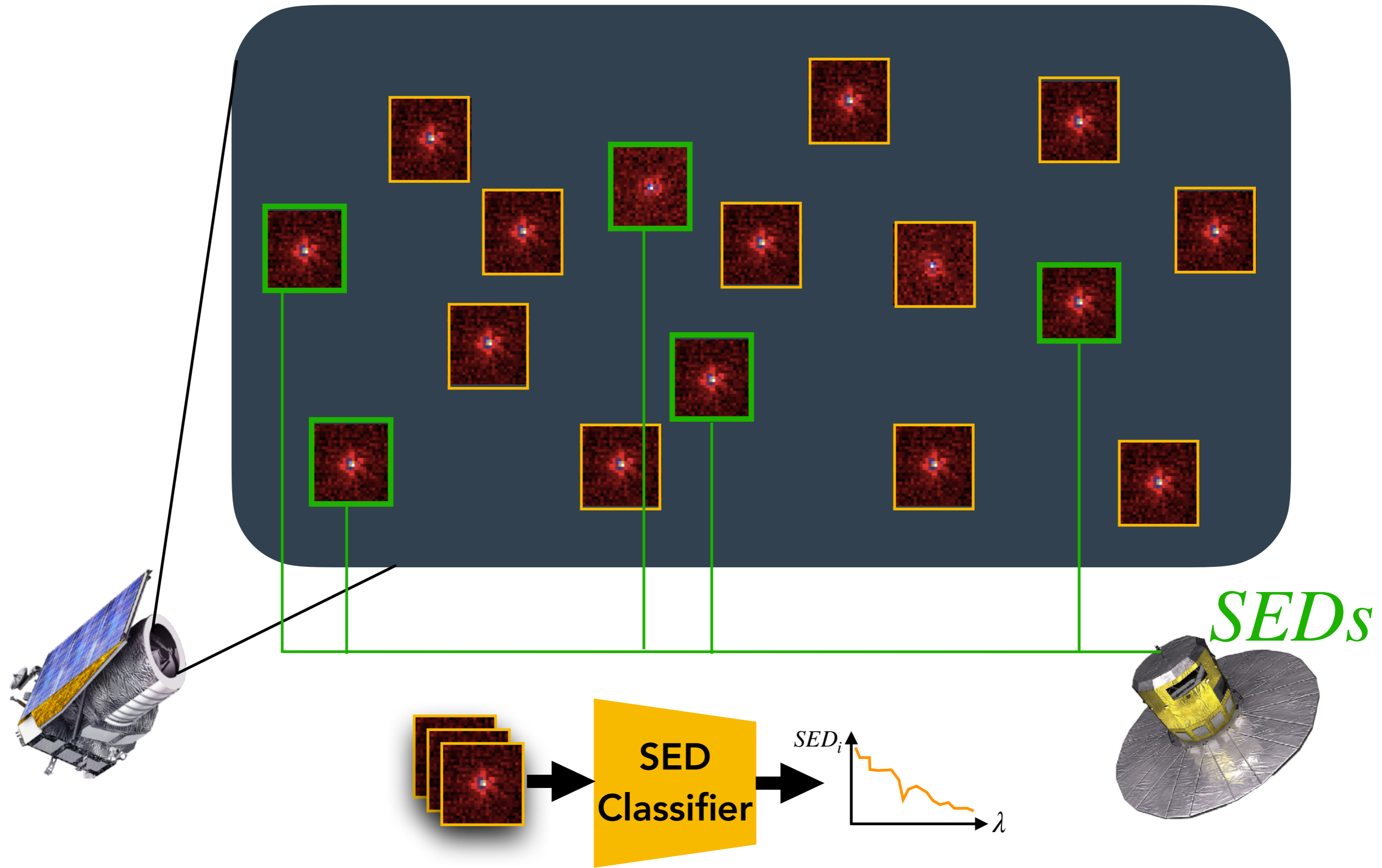
SEDs



SEDs

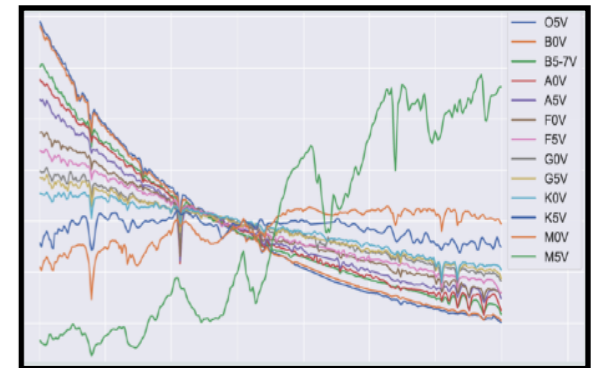
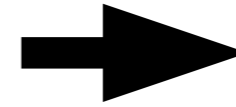
**SED
Classifier**



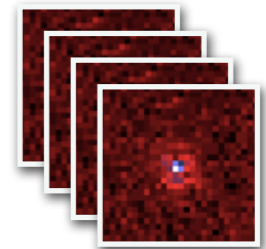
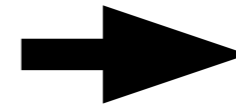


Ingredients for the classifier

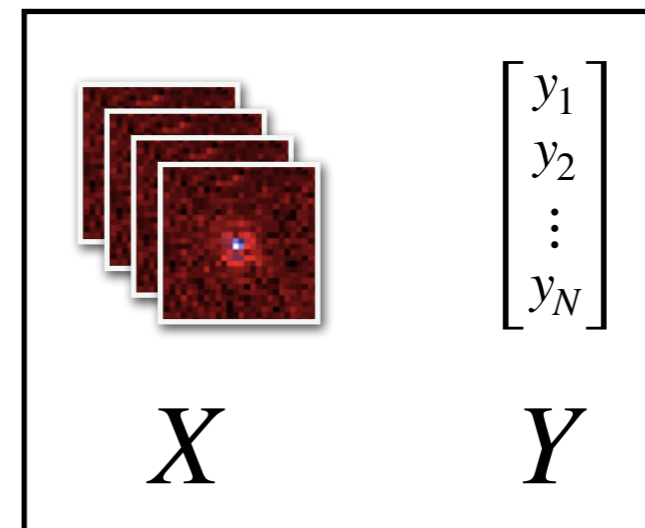
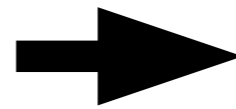
- 13 SED templates from Pickles (1998)



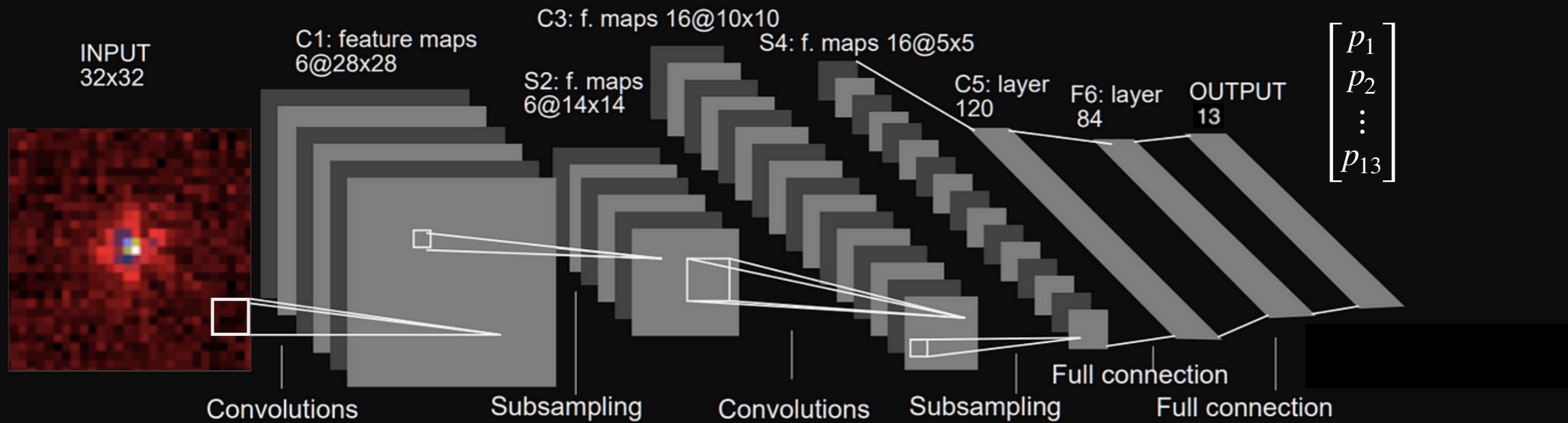
- 10k simulated star observations (PSF) generated with the WaveDiff pipeline



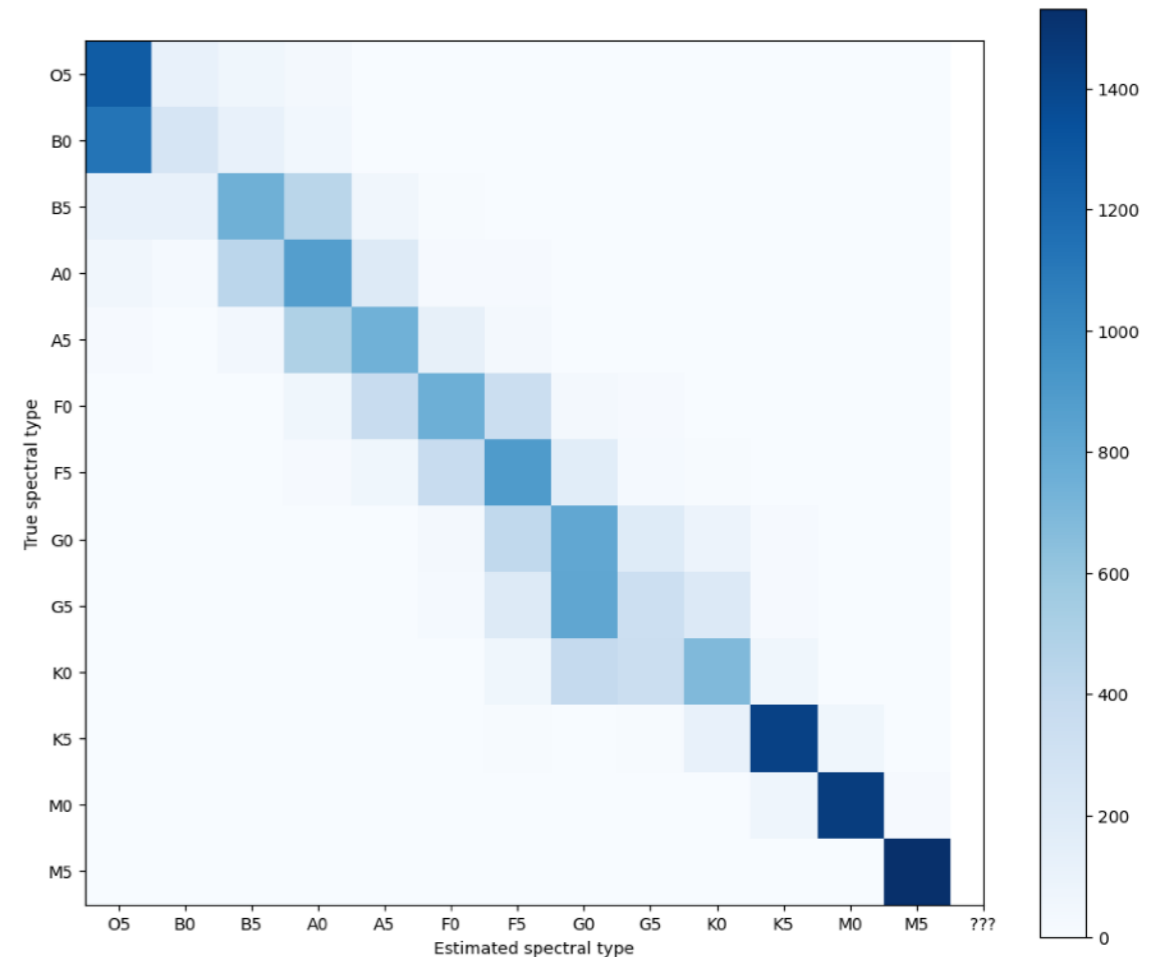
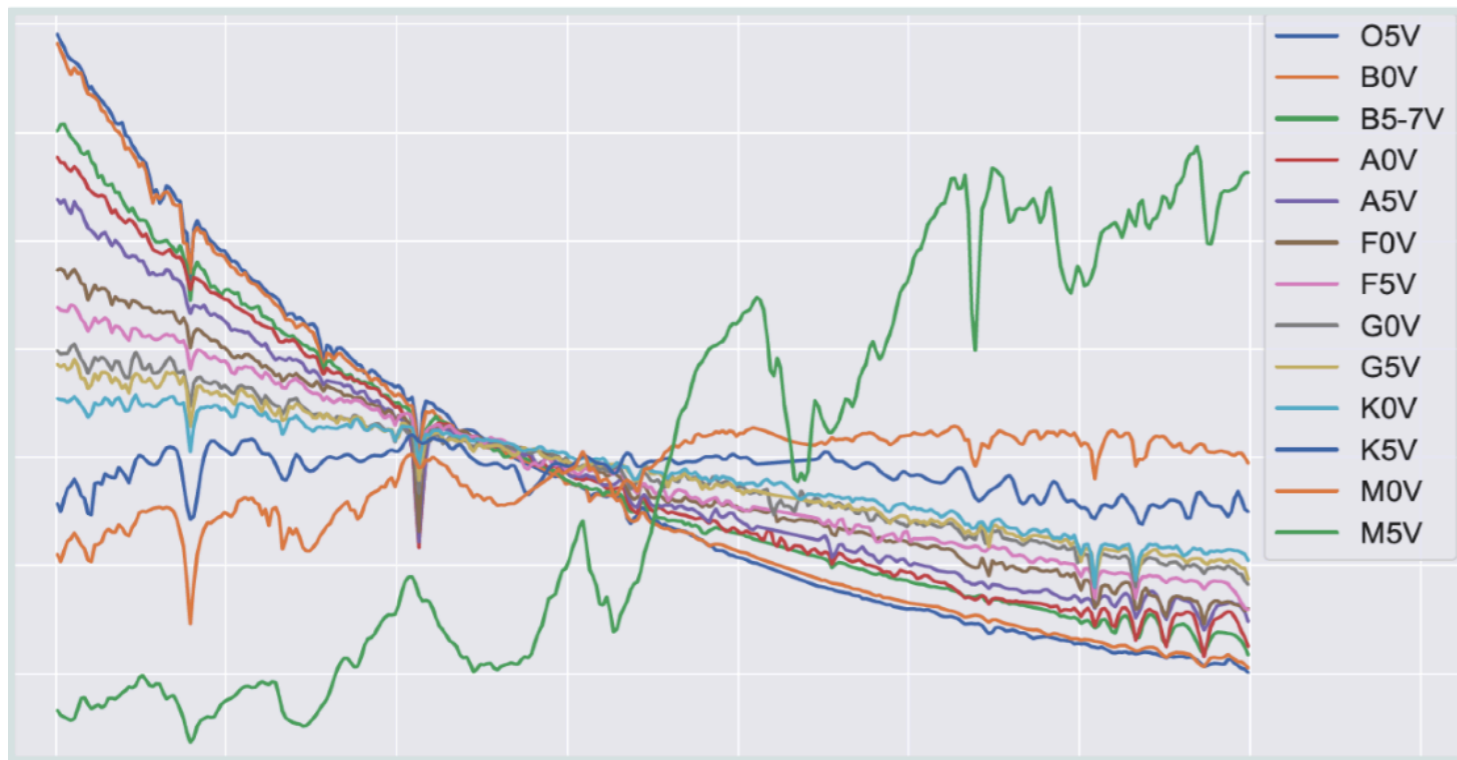
- 10k SED type labels



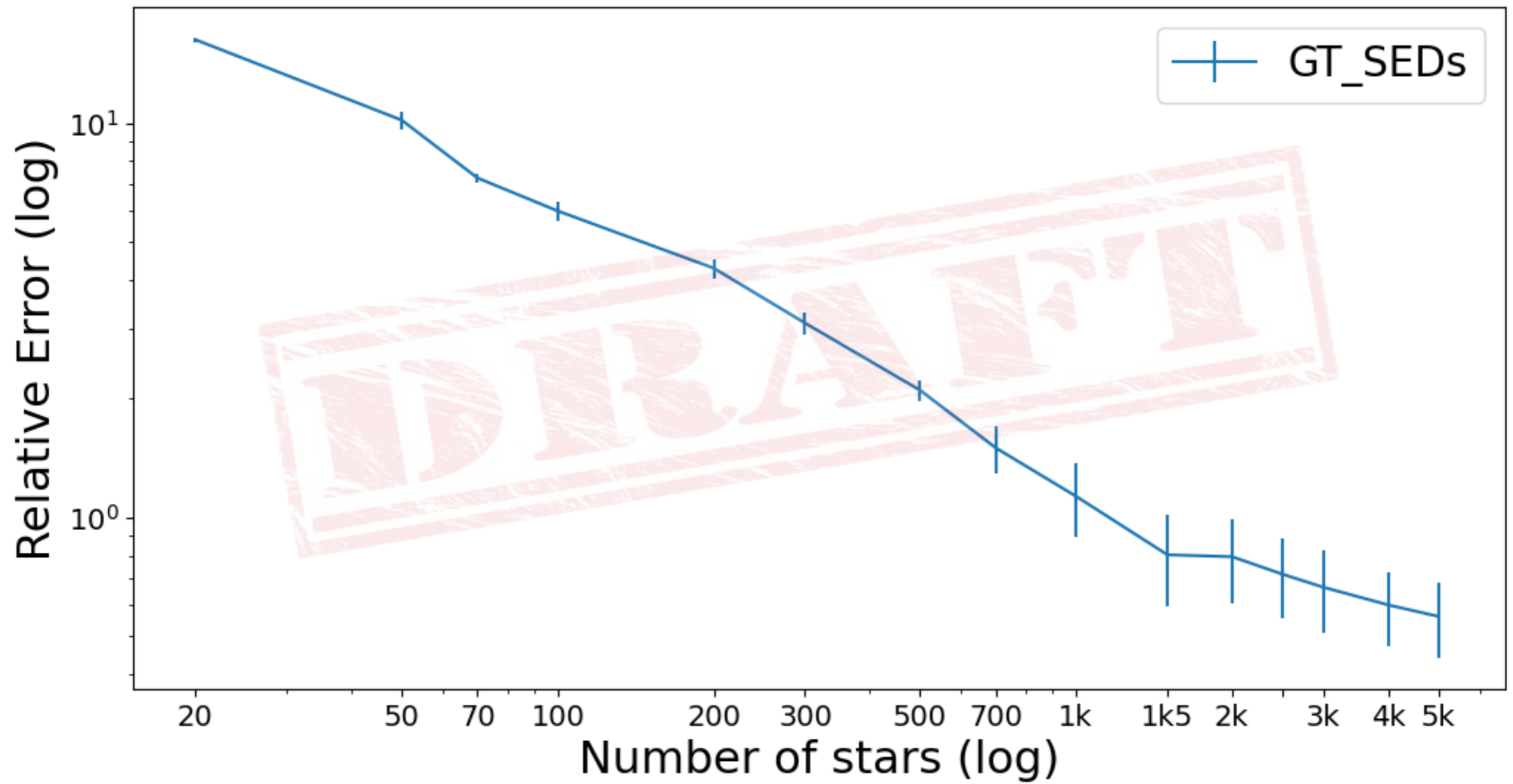
Results



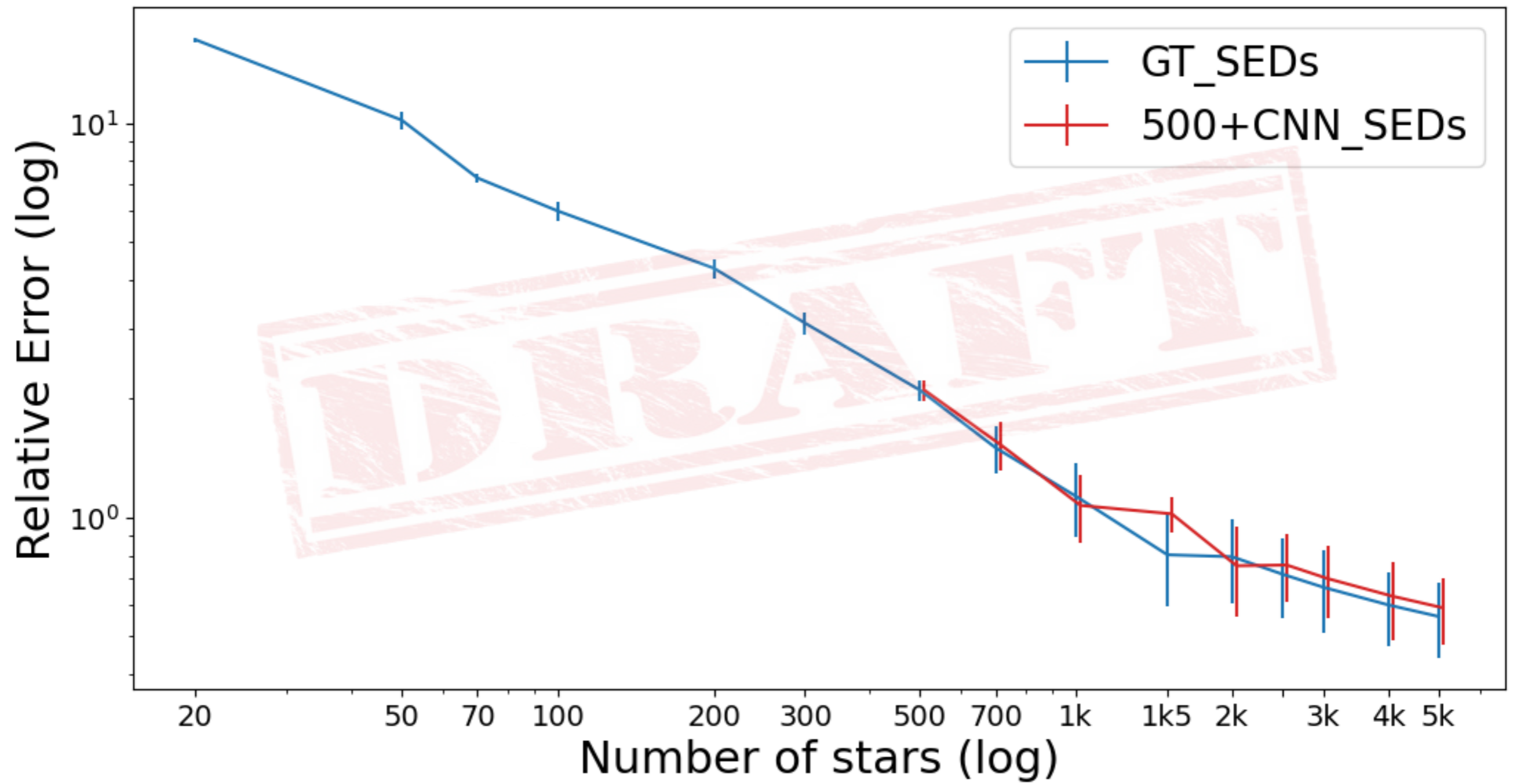
13 SED templates from Pickles (1998)



Predicted-SEDs datasets

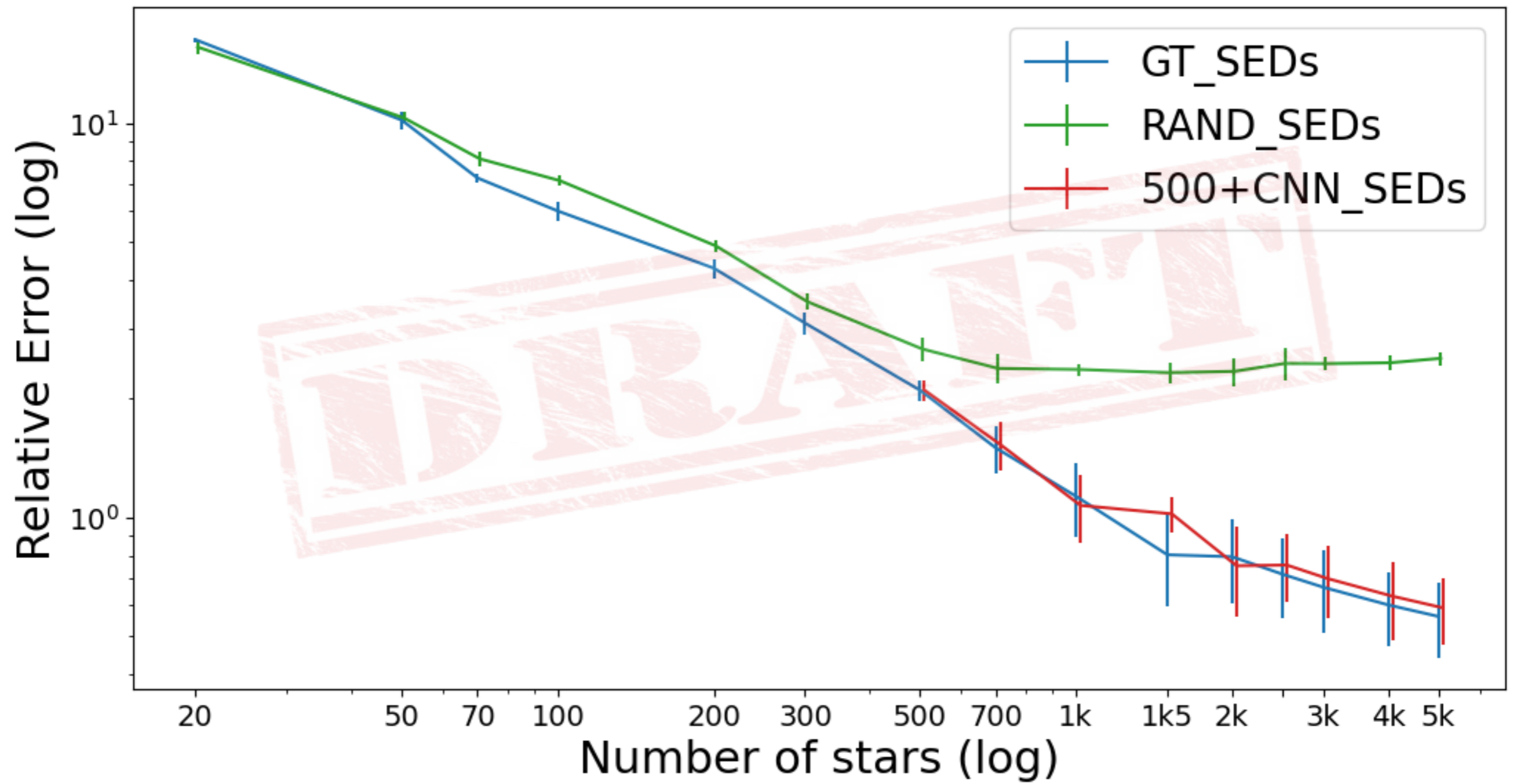


Predicted-SEDs datasets



DRAFT

Predicted-SEDs datasets



Summary

- CNN SED classifier with 90% accuracy.
- Star number increase -> Improve PSF model predictions.

Next steps

- Get more sophisticated image synthesis.
- Are SED templates truly representative?

Future work

- Transfer learning to real data.
- Fully train on real data.

Thanks for your attention!

Questions?

