Generative AI for Image Reconstruction: a First Attempt

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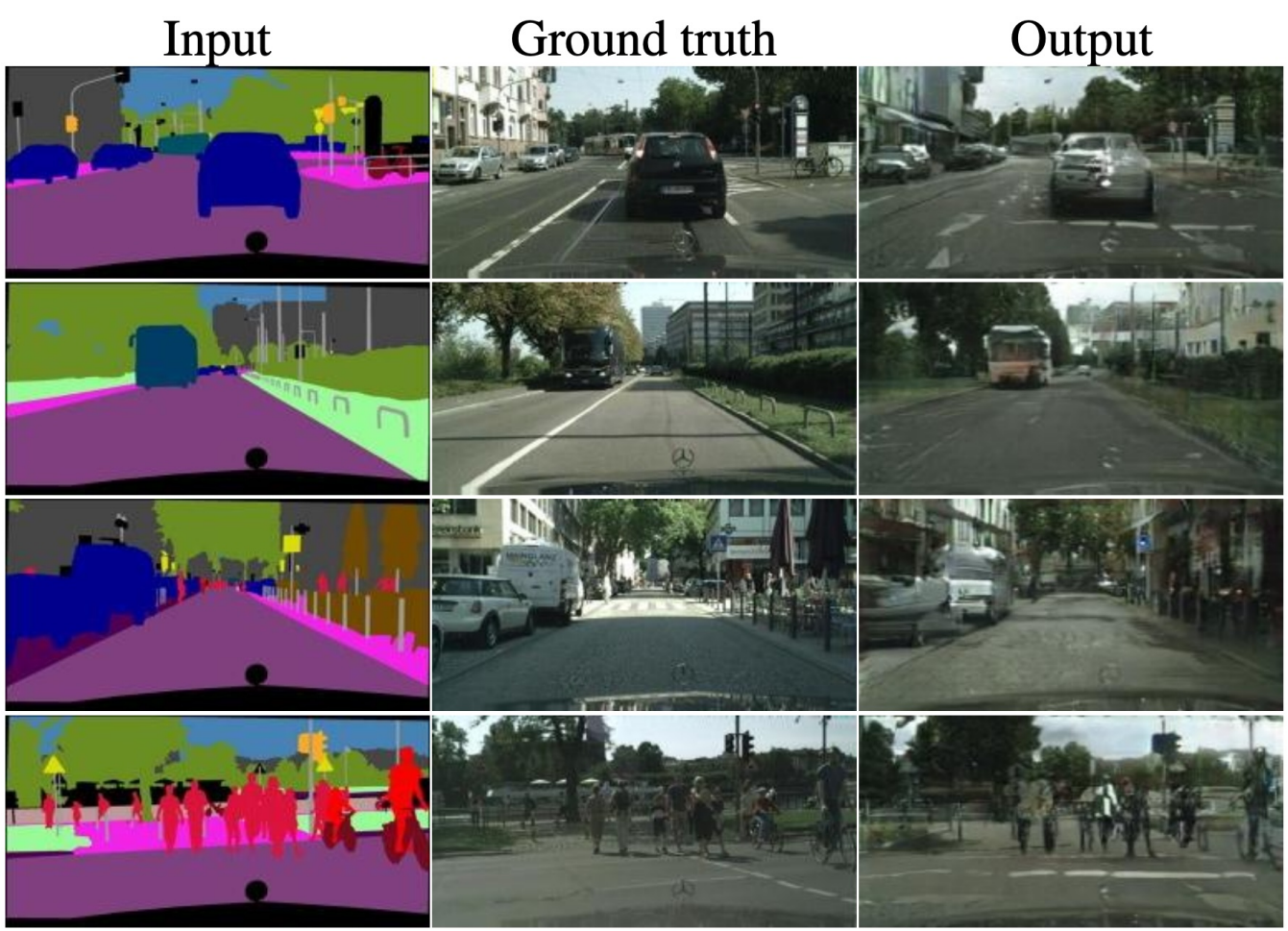
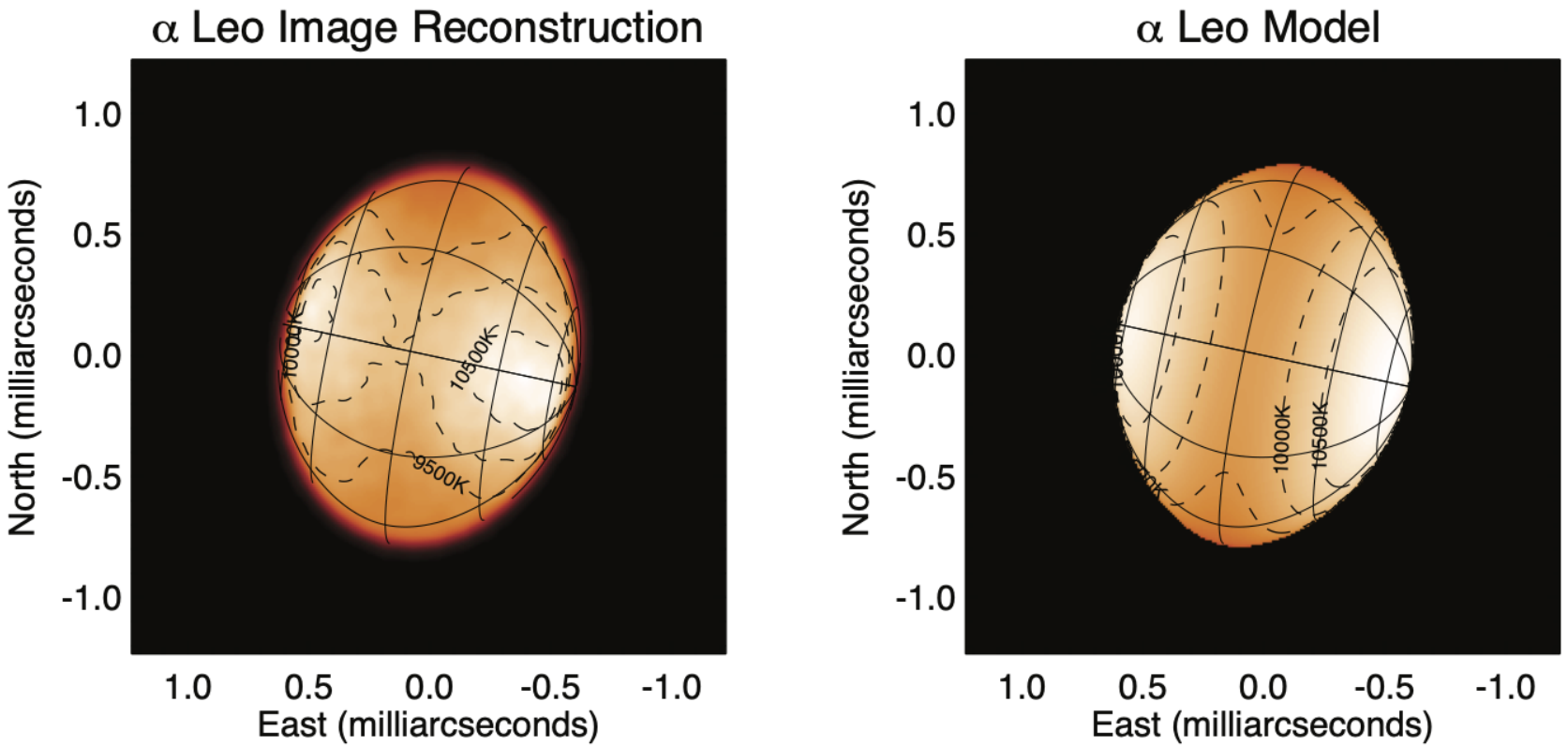
Can we adapt this?

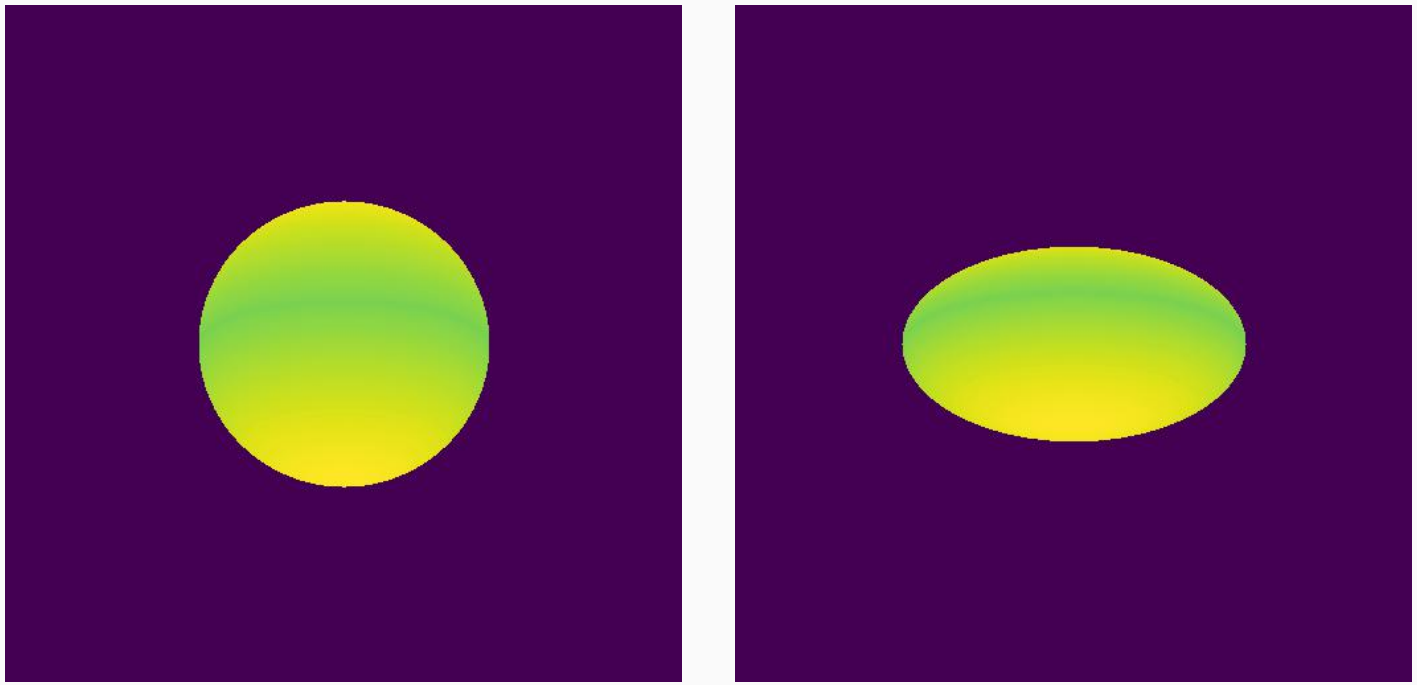


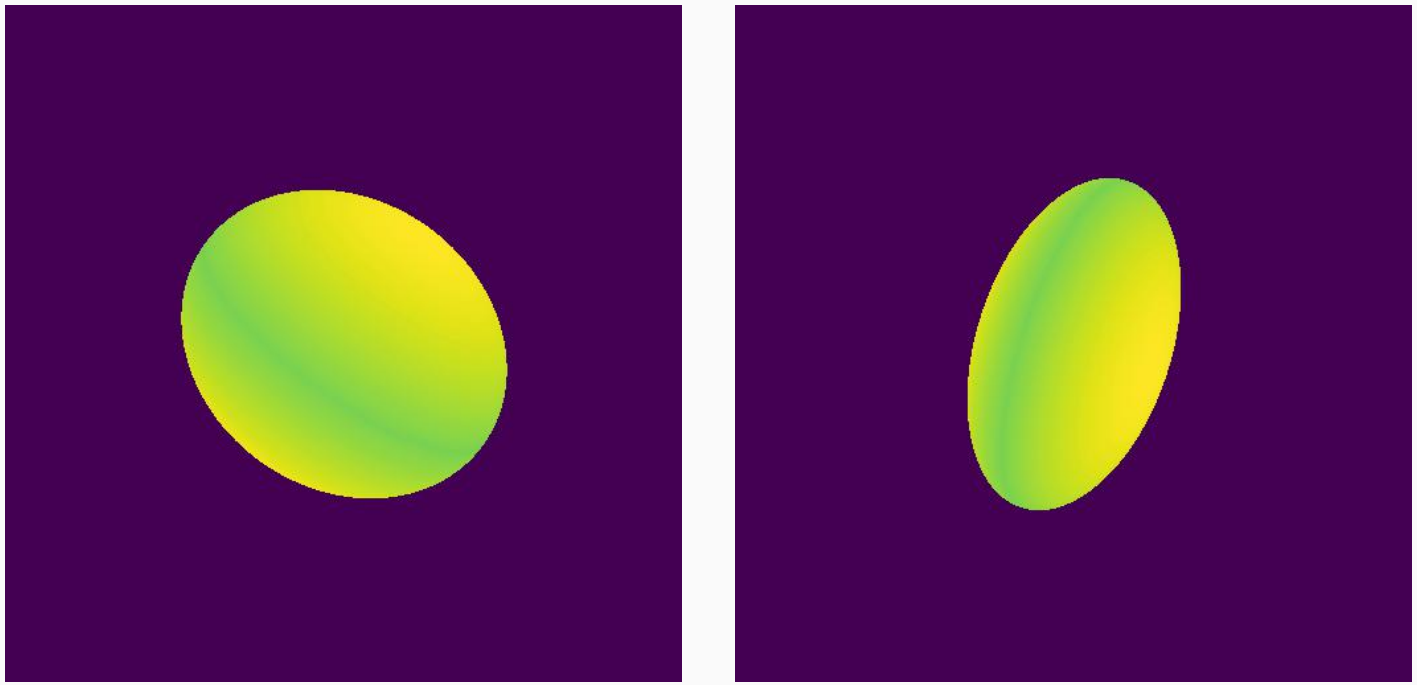
https://phillipi.github.io/pix2pix/

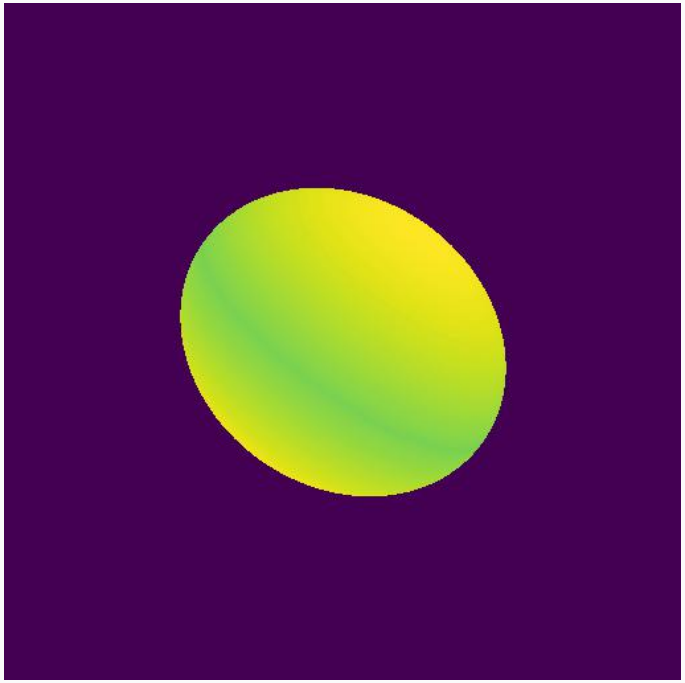
Gravity Darkening

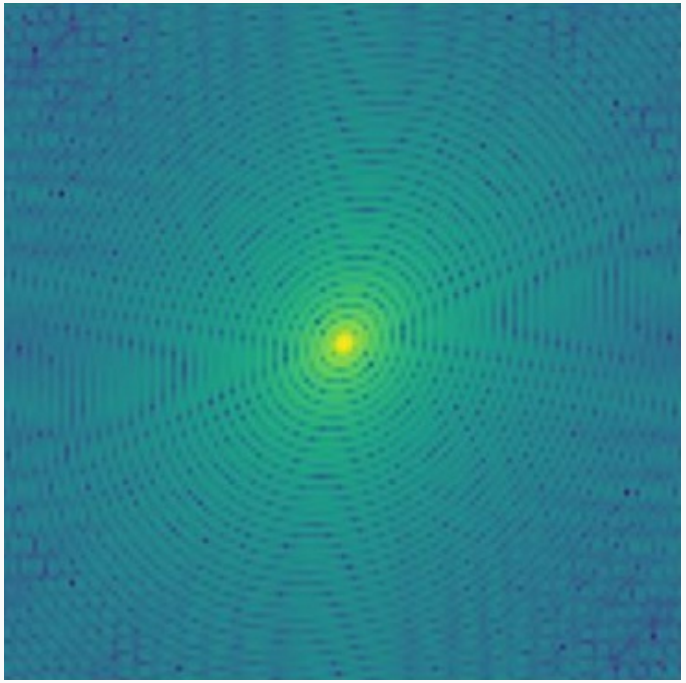


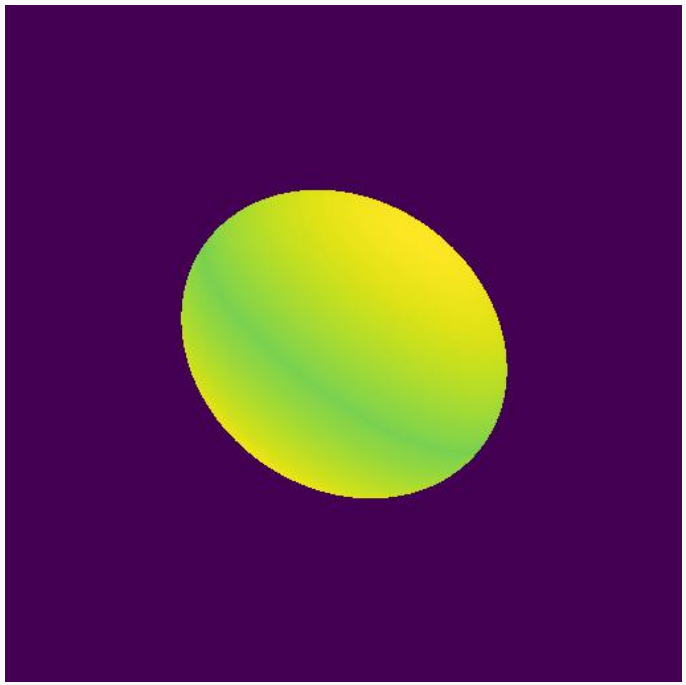
Che et al (2009) using CHARA

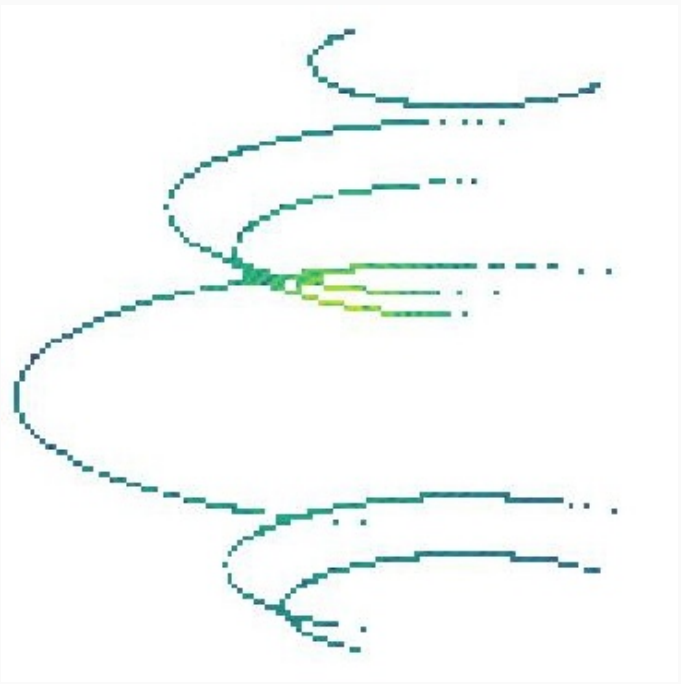








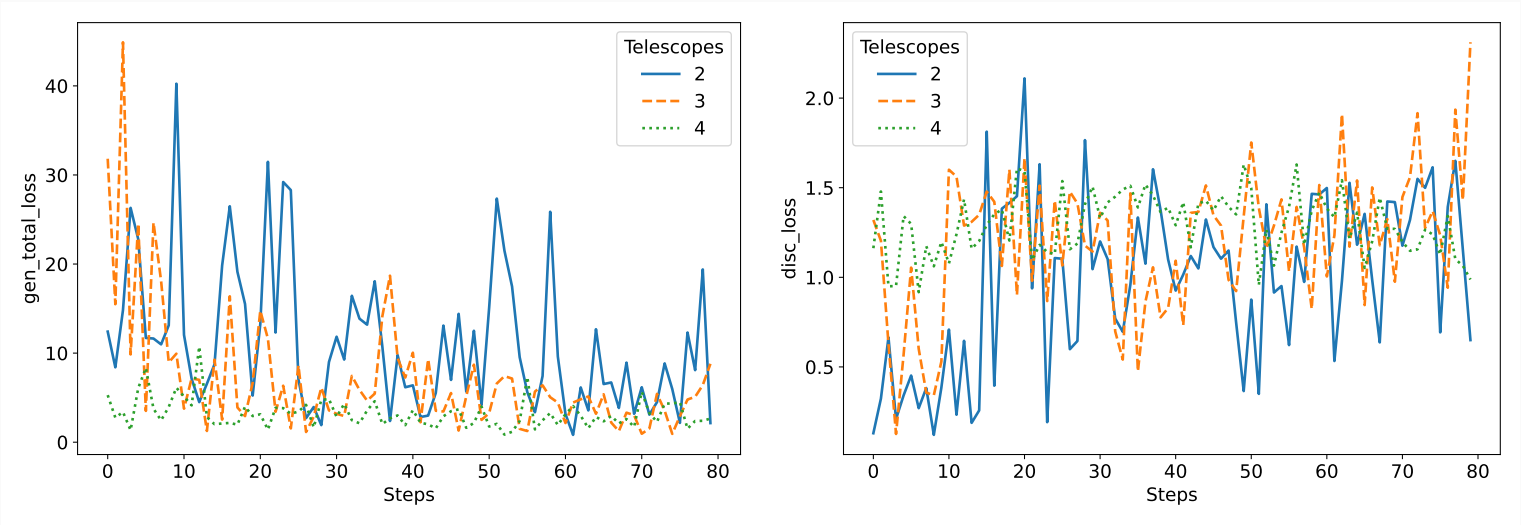




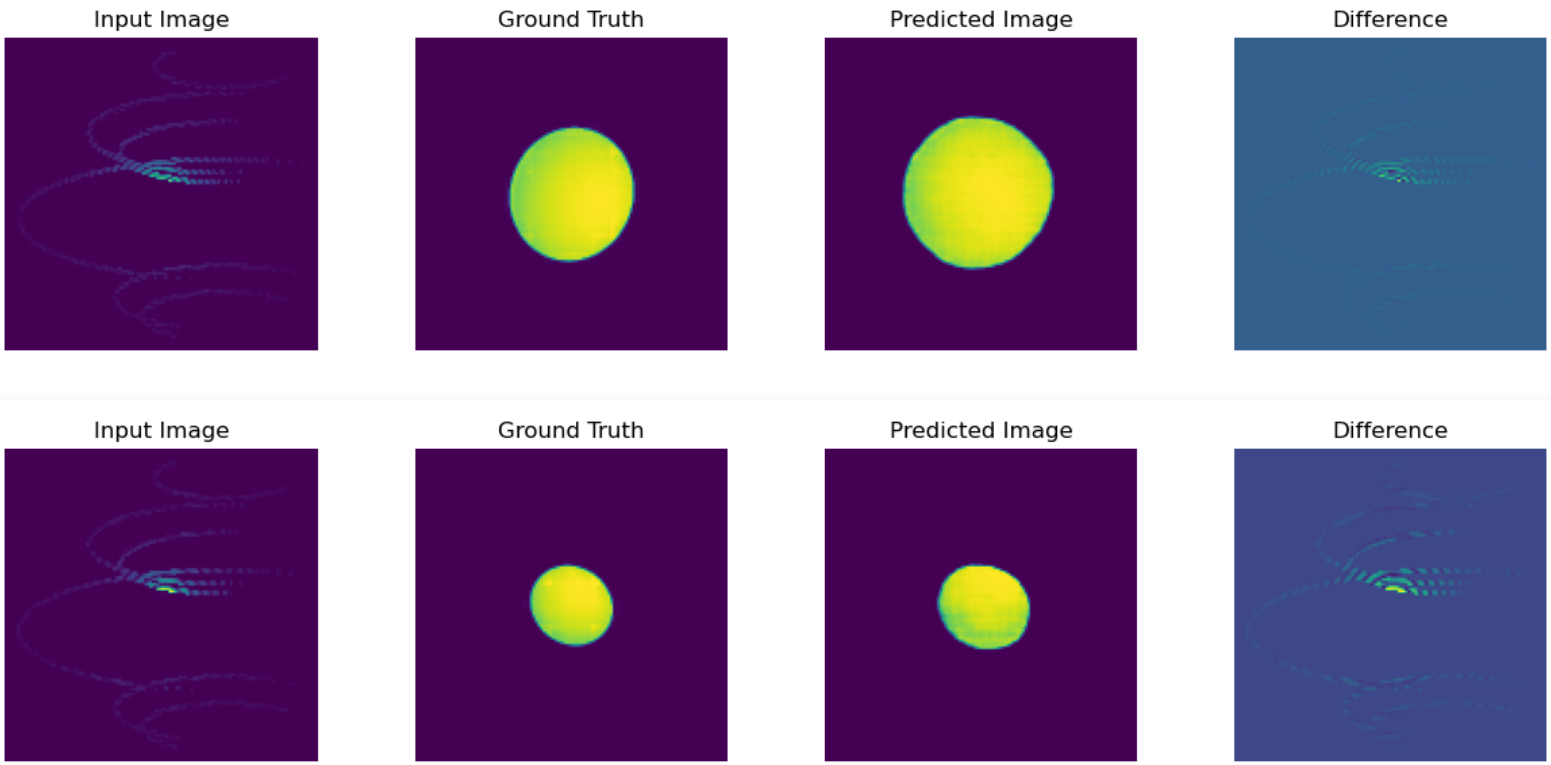
The training set has 60 000 of these.

A cGAN

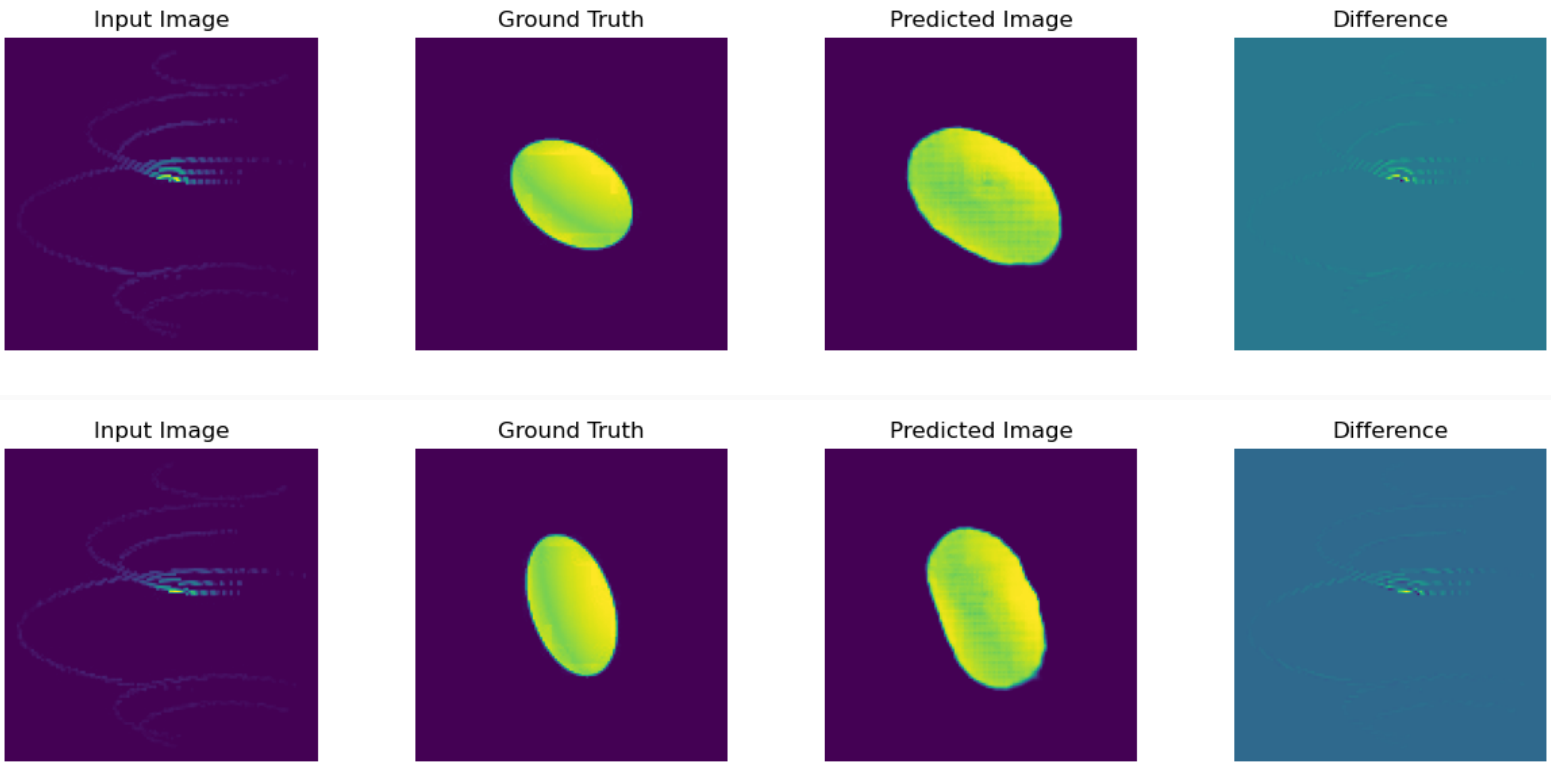
- One network (the generator) produces images from sparse II data.
- A second network (the discriminator) separates good and bad images.
- These are trained alternately.



Results


Input Image
Ground Truth
Predicted Image
Difference
Input Image
Ground Truth
Predicted Image
Difference

Results


Input Image
Ground Truth
Predicted Image
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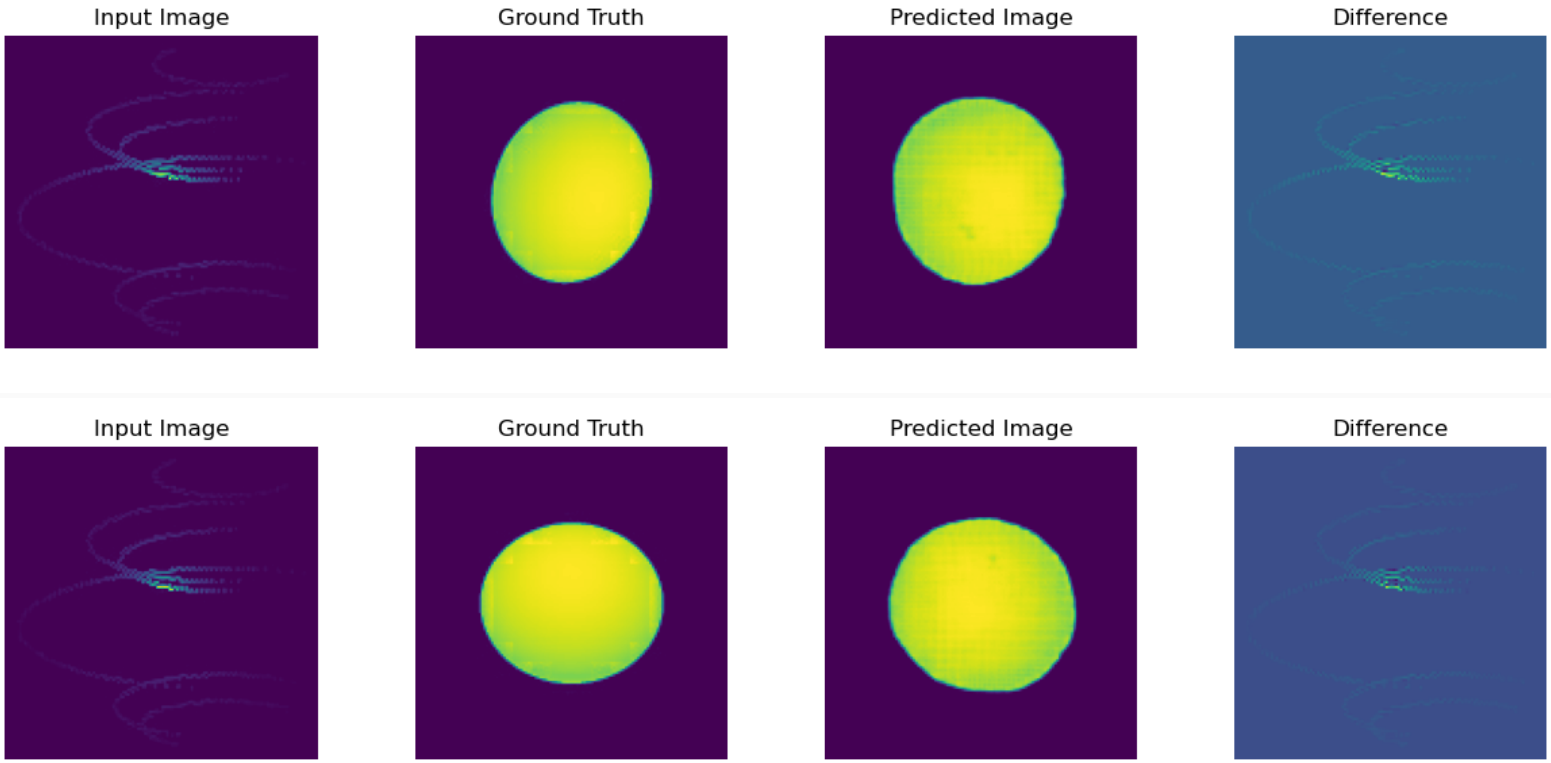
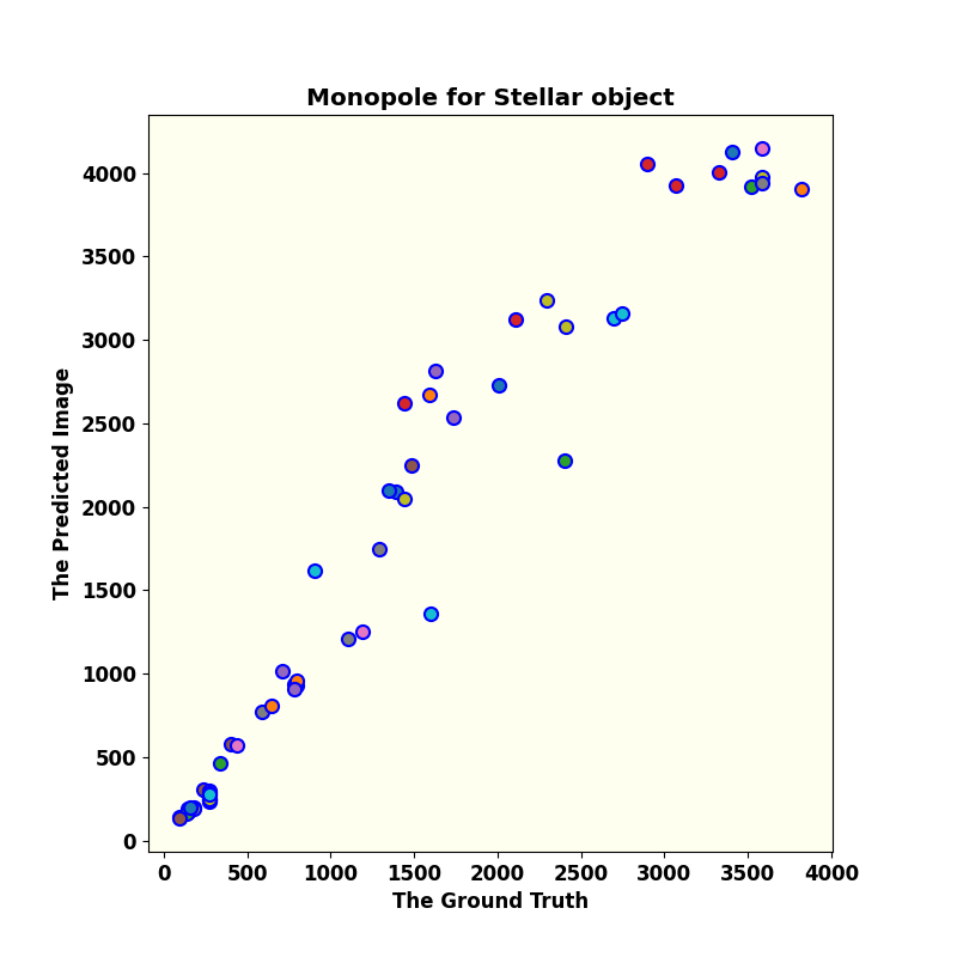
Input Image
Ground Truth
Predicted Image
Difference

Results

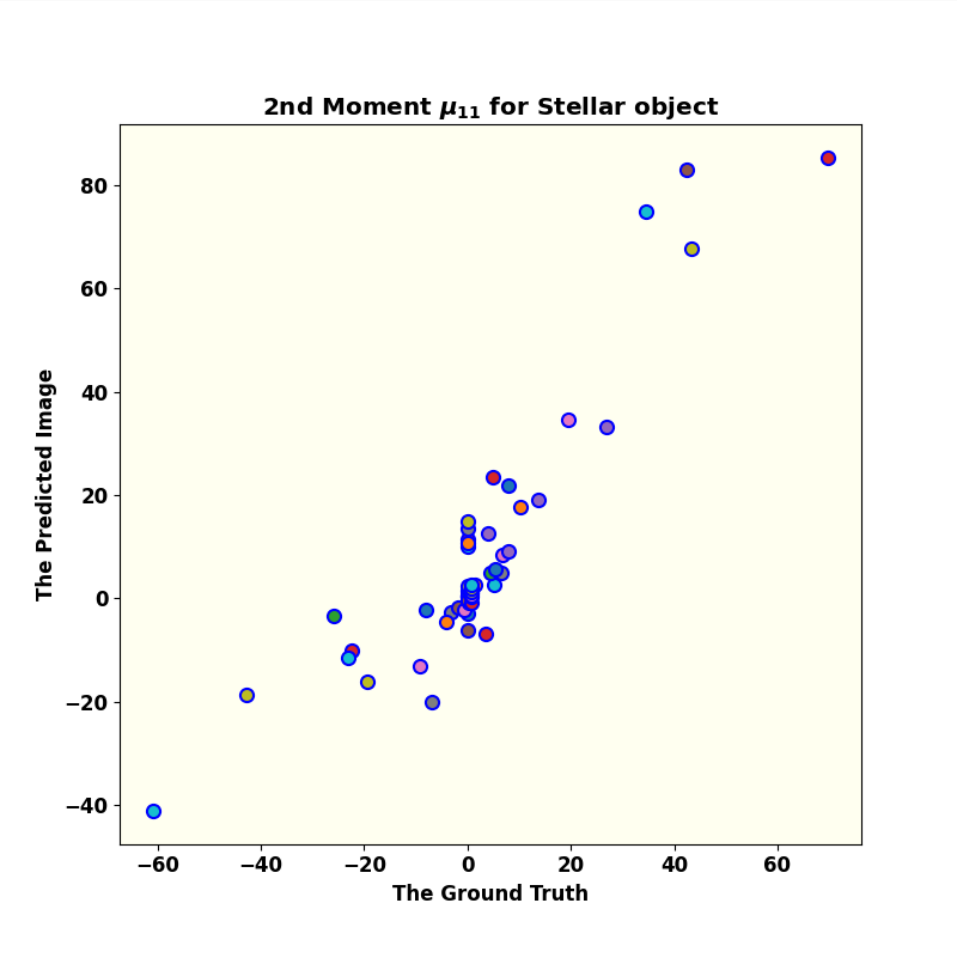

Input Image
Ground Truth
Predicted Image
Difference
Input Image
Ground Truth
Predicted Image
Difference

Recovery of Multipoles



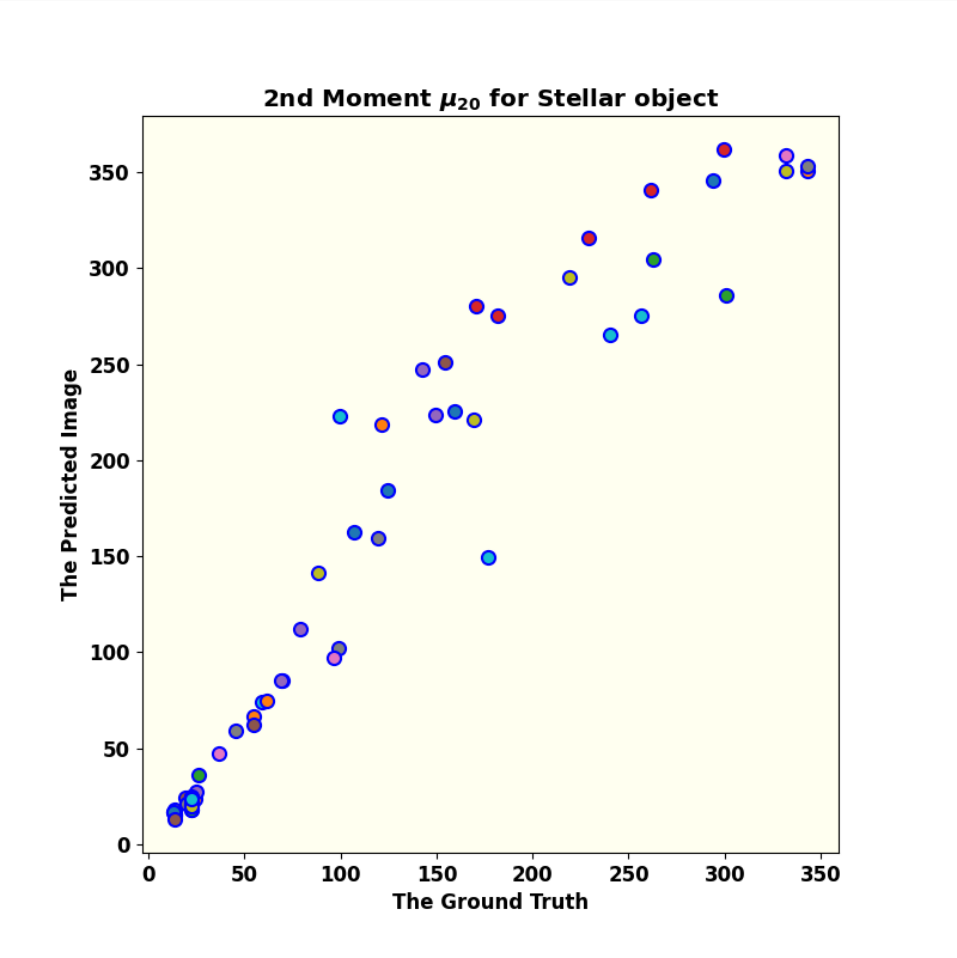
Monopole is well recovered.

Recovery of Multipoles



Second moment is also well recovered.

Recovery of Multipoles



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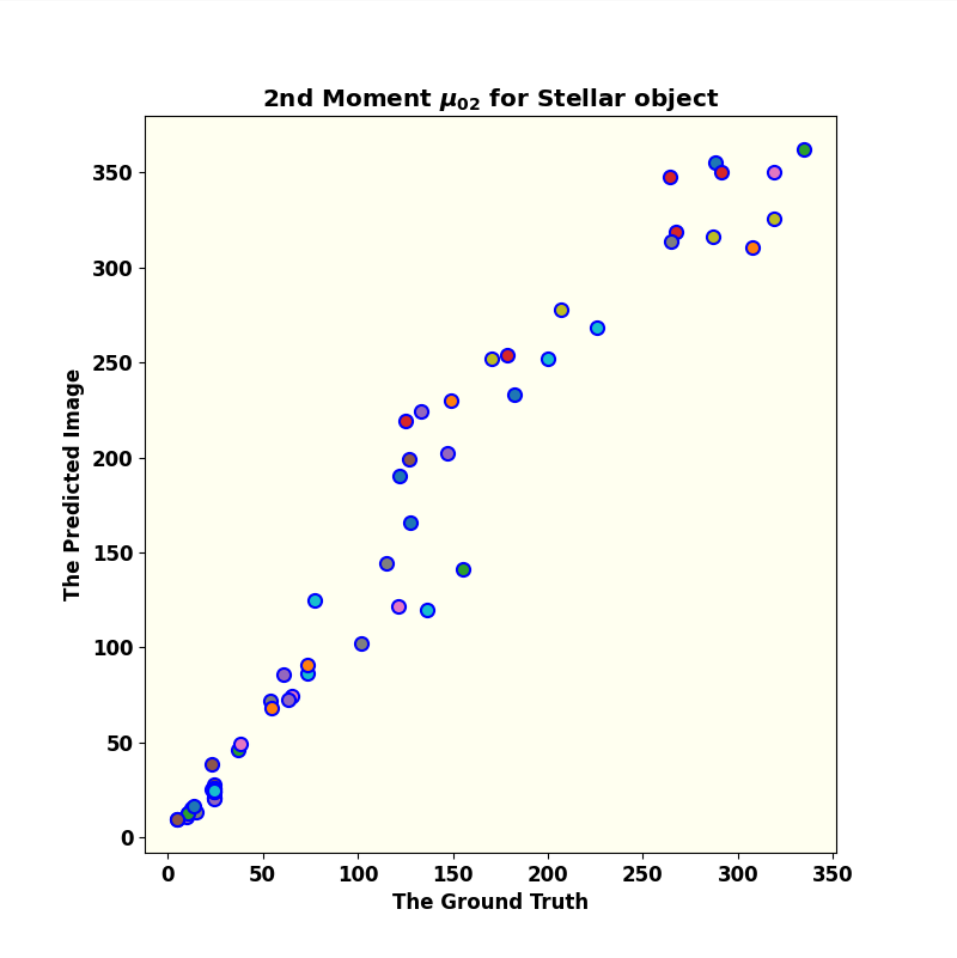

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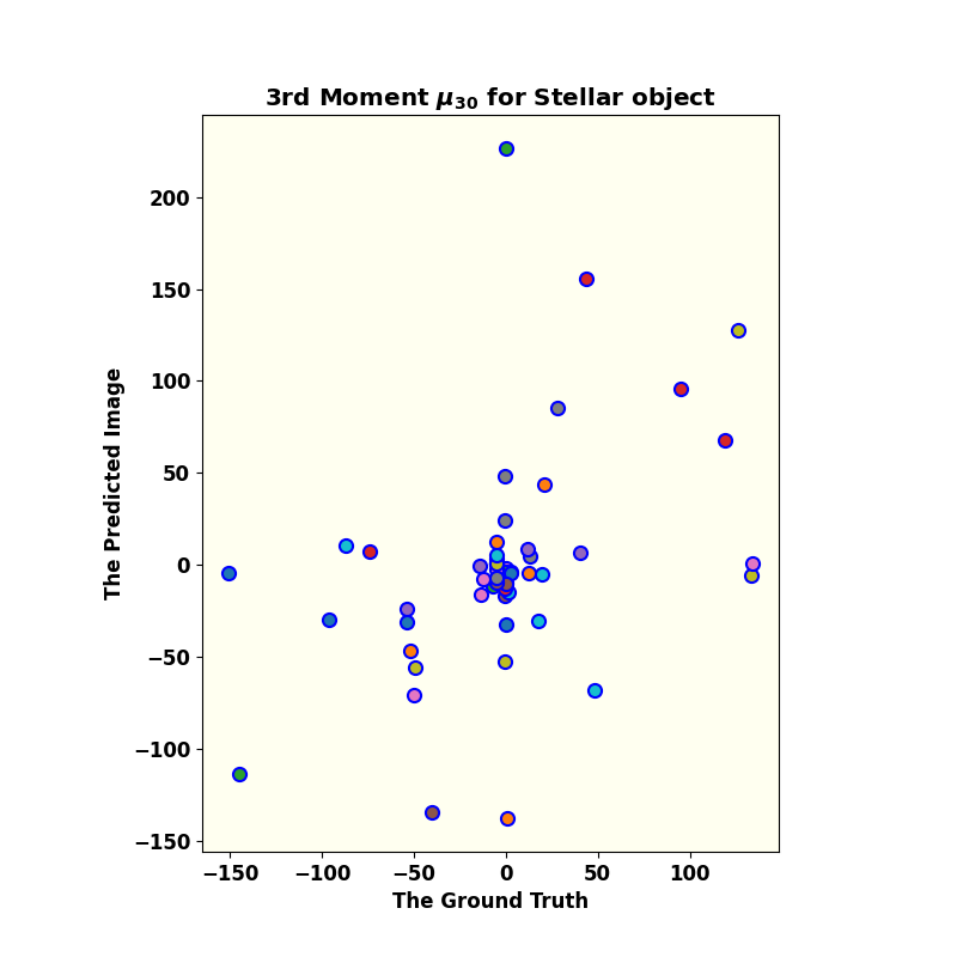
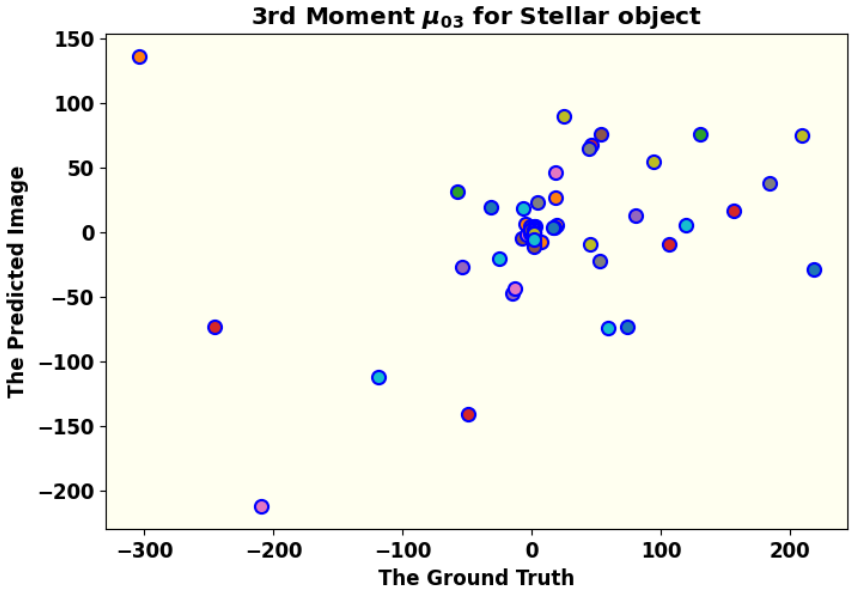


Third moment is less good.

Recovery of Multipoles



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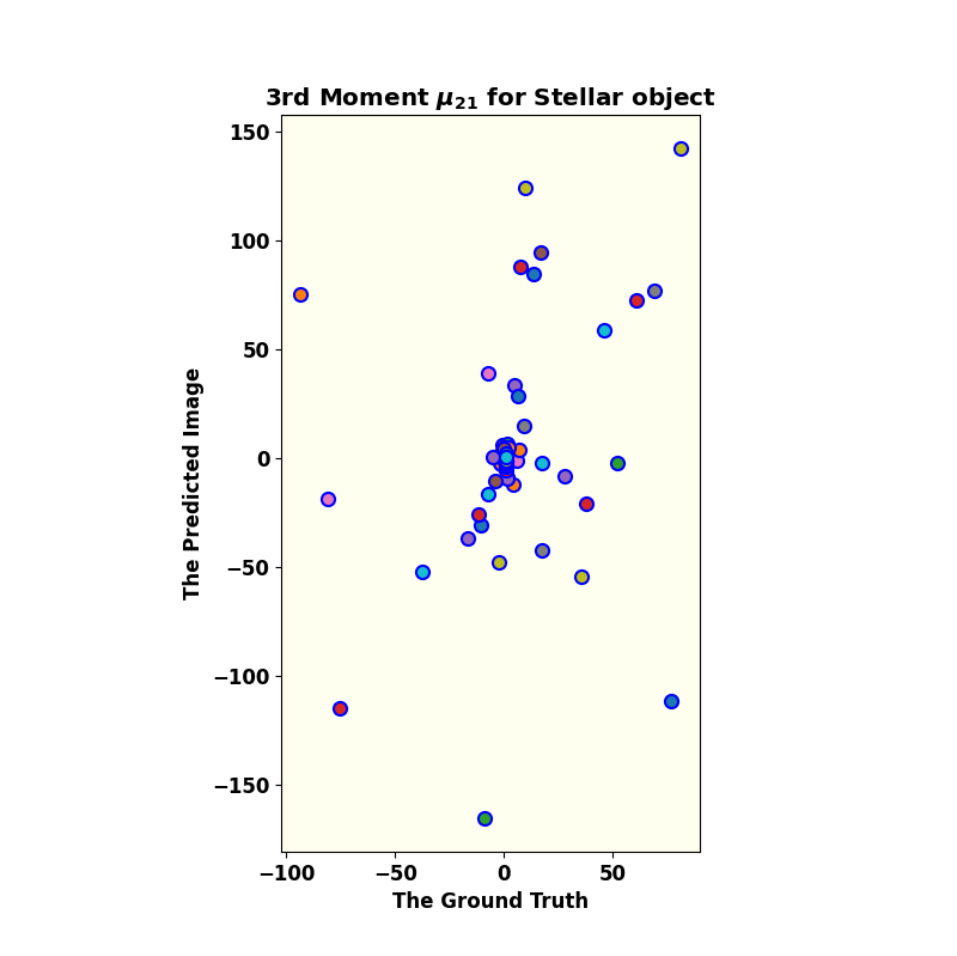
Recovery of Multipoles



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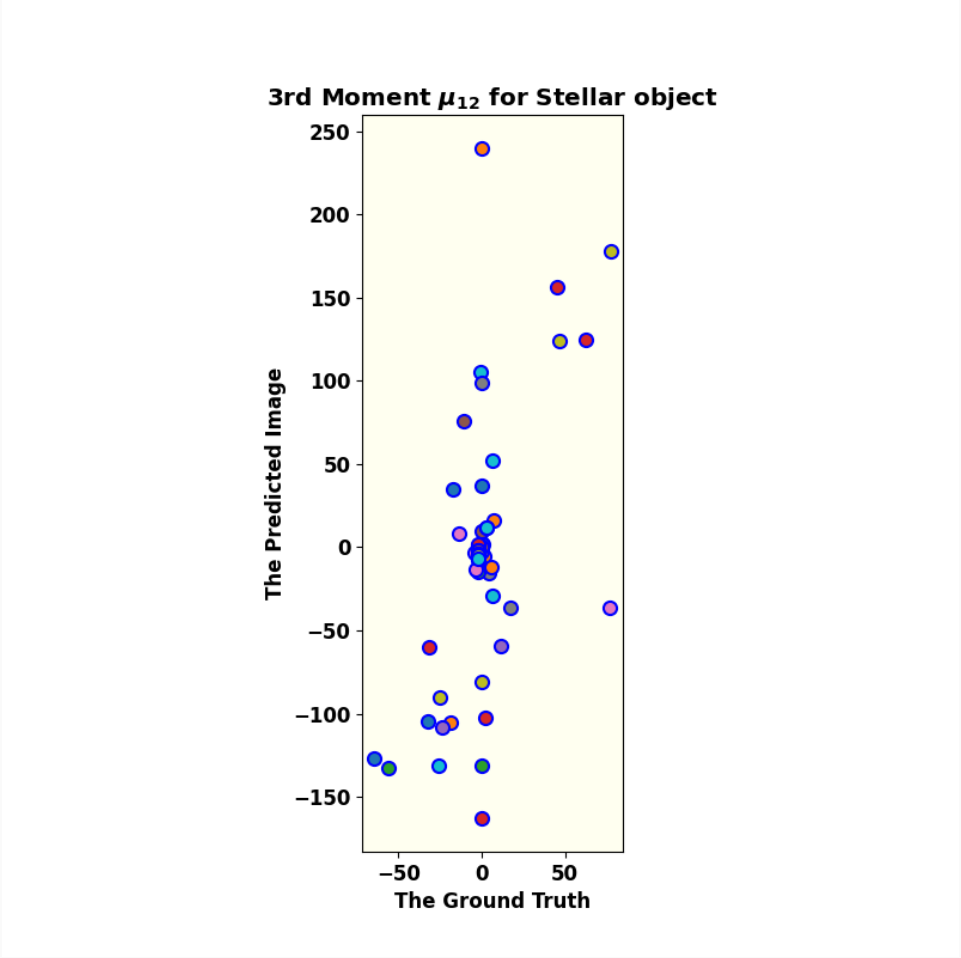

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Summary

- Adapting an off-the-shelf code gives encouraging results for reconstructing gravity-darkening using ${}^4C_2$ baselines.

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- Interpretion of loss functions desirable.
- Next step: simulations of interacting binaries as training set?