ASTROMETRIC PLATE SOLVING

PHYS 605 Term Project Presentation

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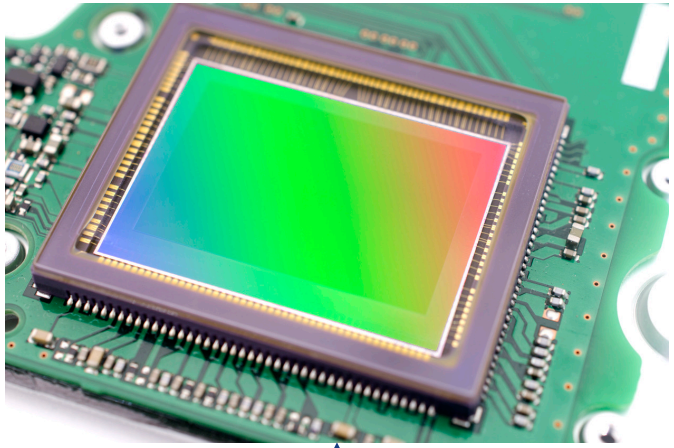
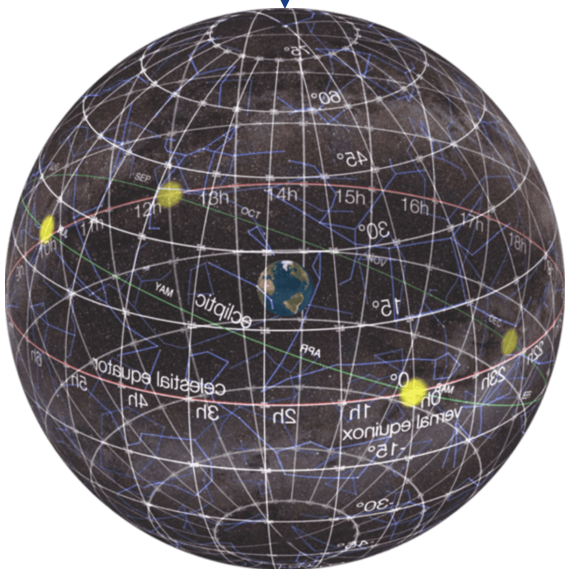
INTRODUCTION

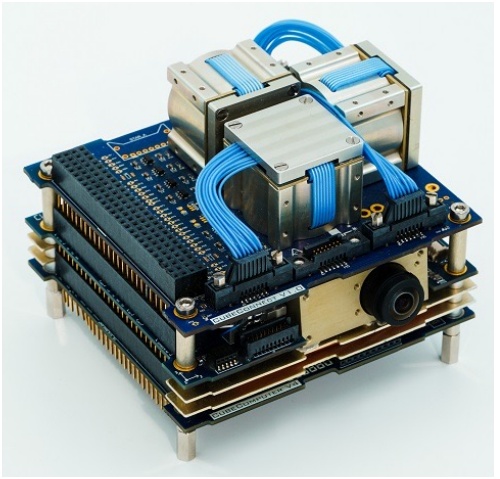
Astrometric plate solving

- The process of obtaining WCS information from an image. [1]
- Extremely important technique in astronomy and Attitude Determination and Control Systems in satellites [2]



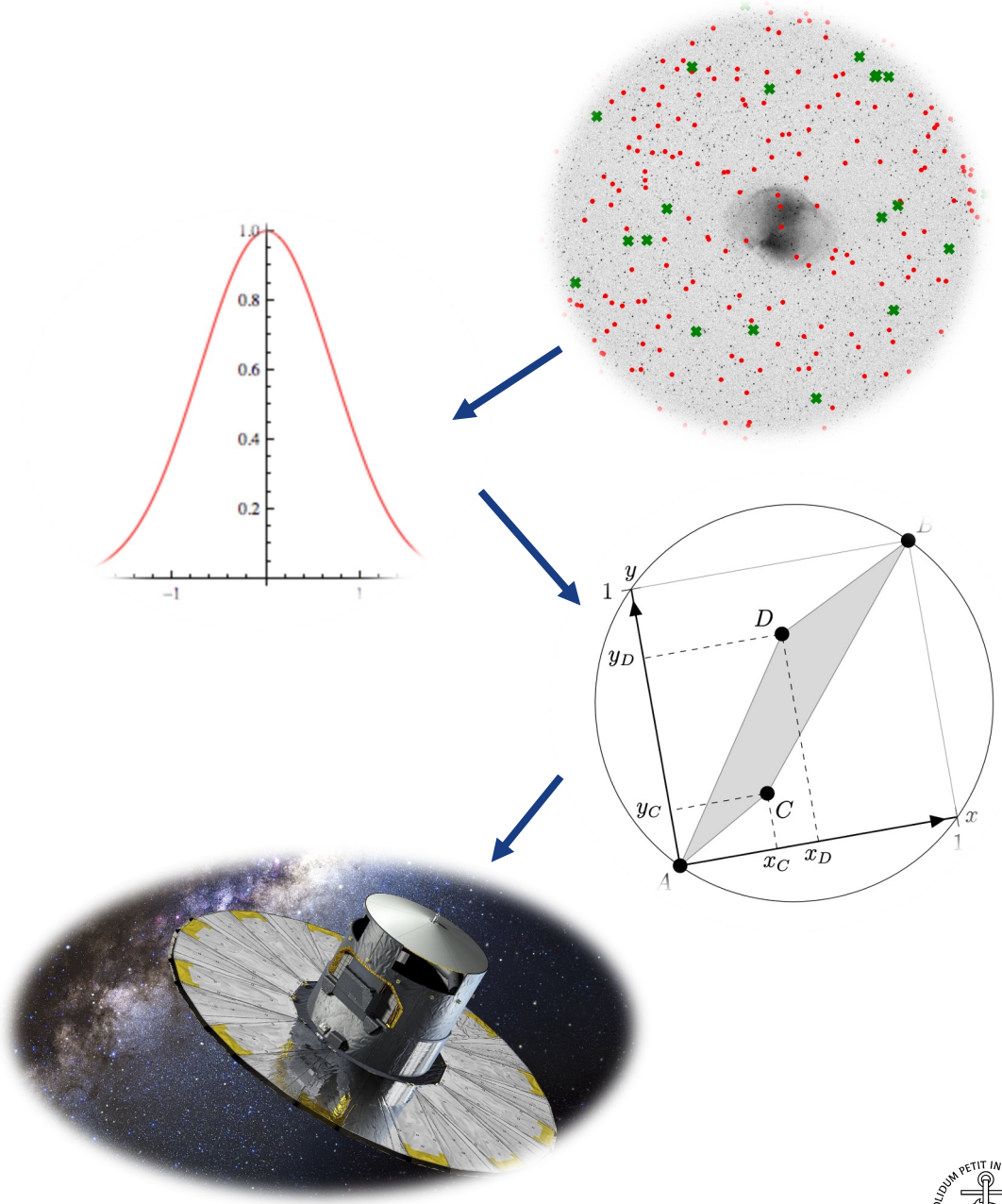
World Coordinate System ↕ **(WCS)**





METHODS

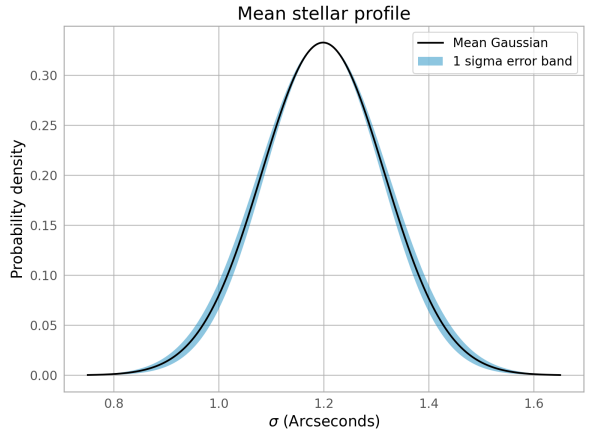
- 2D Convolution techniques for star detection
- Fitting of stars to gaussian profiles
- Examination of statistical properties of stars and using this to reject outliers
- Dimensionality reduction (by Hashing algorithm [1], not PCA)
- Data fetching and handling from remote databases (GAIA DR2[3])
- **TODO:** Bayesian inference for comparing the quality of proposed solutions

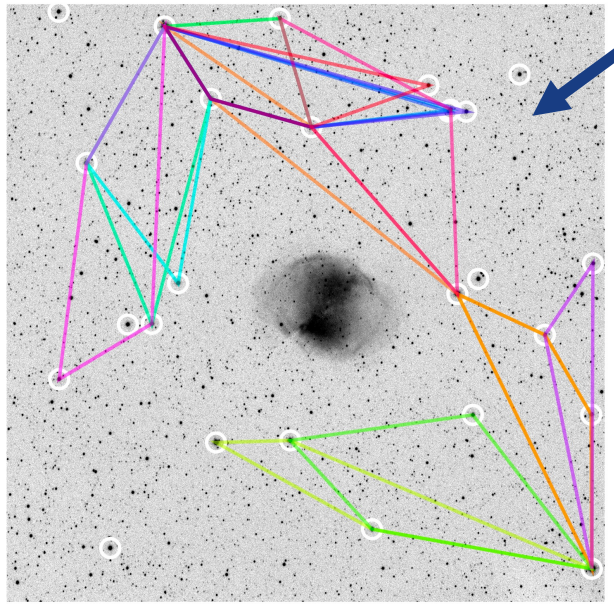


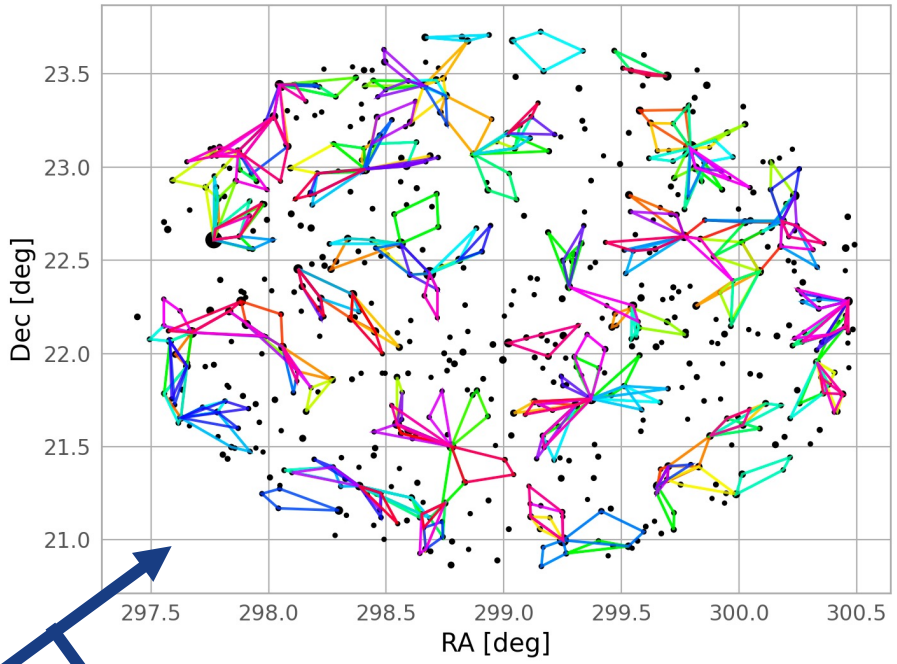
RESULTS AND TESTS

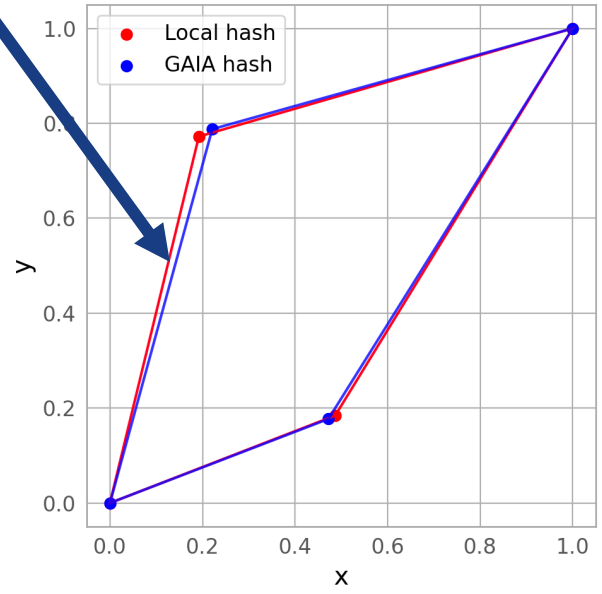
- Stars detected and asterisms built
- Matched to GAIA catalogue index asterisms
- Input image stellar shape parameters determined

- **Original idea**: Hash from both geometry and relative flux
  - ➢ <u>Does not work</u> because of saturation effects and band variance.









REFERENCES

[1] Lang, D., Hogg, D. W., Mierle, K., Blanton, M., & Roweis, S. (2010). Astrometry. net: Blind astrometric calibration of arbitrary astronomical images. The astronomical journal, 139(5), 1782. (https://arxiv.org/abs/0910.2233)

[2] Starin, Scott R. and John S. Eterno. “Attitude Determination and Control Systems.” (2010) (https://ntrs.nasa.gov/api/citations/20110007876/downloads/20110007876.pdf)

[3] Katz, D., Antoja, T., Romero-Gómez, M., Drimmel, R., Reylé, C., Seabroke, G. M., ... & Gaia Collaboration. (2018). Gaia data release 2: mapping the Milky Way disc kinematics. arXiv preprint arXiv:1804.09380 (https://arxiv.org/abs/1804.09380).

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