Estudos de pequenos corpos do Sistema Solar com o LSST

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Workflows e Plataformas Científicas: preparação para o LSST DR1

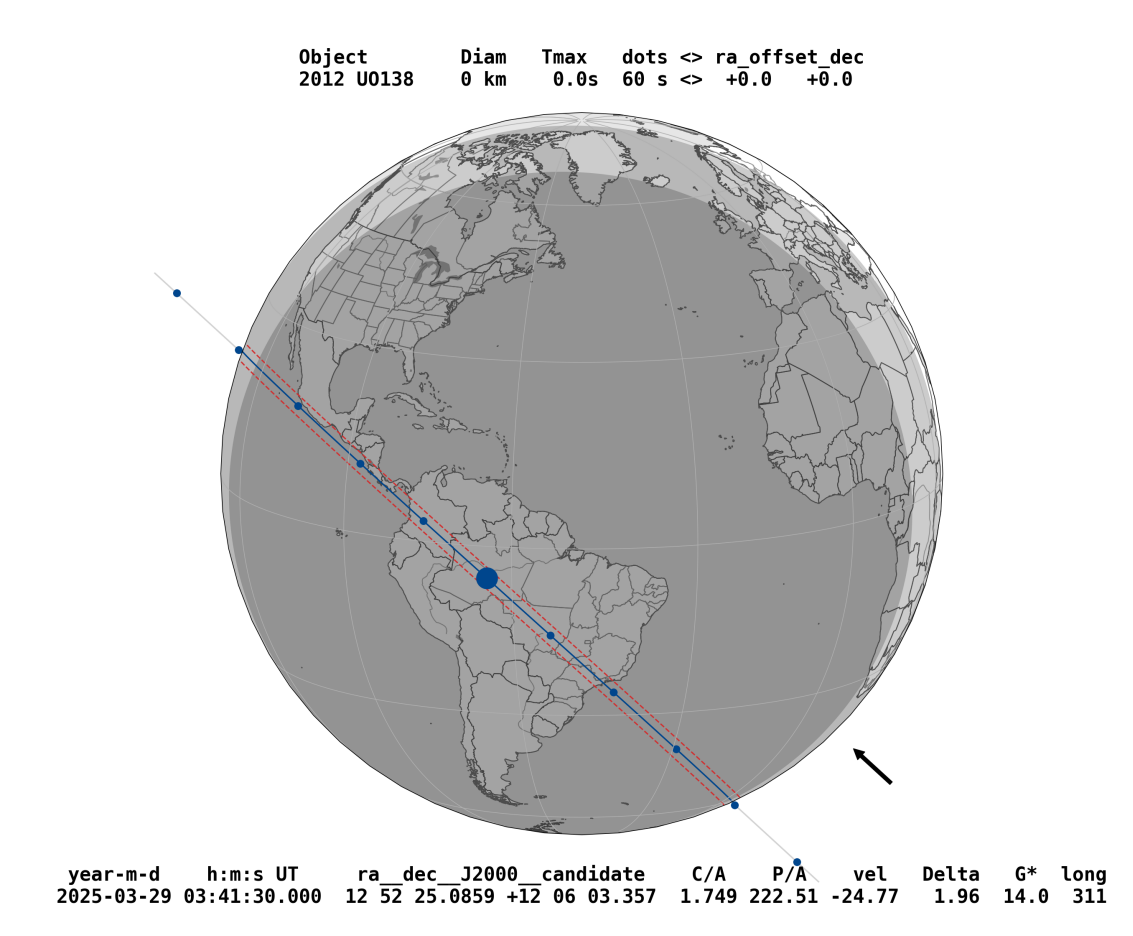
Stellar Occultations: The Predictions

- LIneA Occultation Prediction Database

Inclusion of all known asteroids

Use of proprietary astrometry to refine orbits

Possibility to obtain predictions for 1-2 years ahead of current date

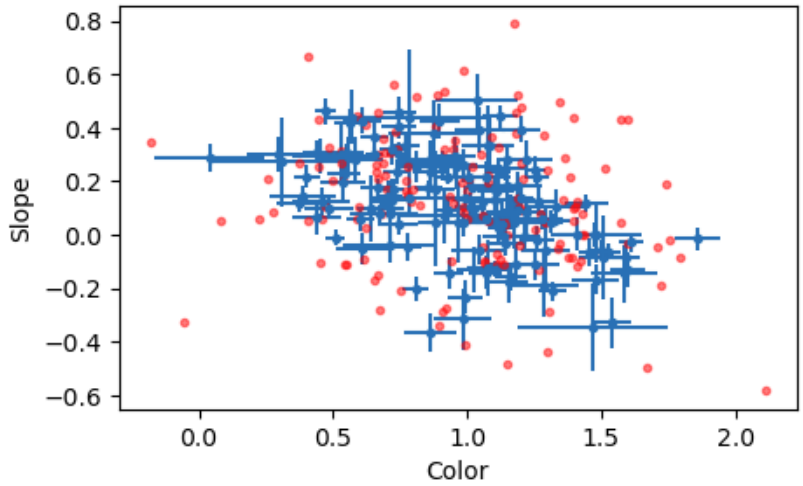


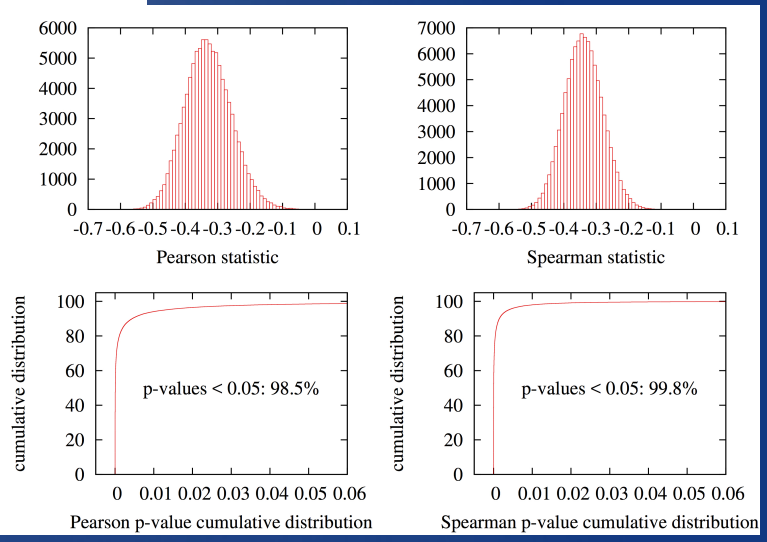
Data analysis: Probing the whole space of possibilities

- Jupyter Notebook

```
[2]: x, x_err, y, y_err = np.loadtxt('gi_betag.txt', usecols=(0,1,2,3), unpack=True, dtype=float

fig = plt.figure(figsize=(5,3))
plt.errorbar(x, y, xerr=0.5*x_err, yerr=0.5*y_err, fmt='.')
plt.plot(np.array(list(map(worker, list(zip(x, x_err))))), np.array(list(map(worker, list(
plt.xlabel('Color')
plt.ylabel('Slope')
plt.show()
```





How many? How much?

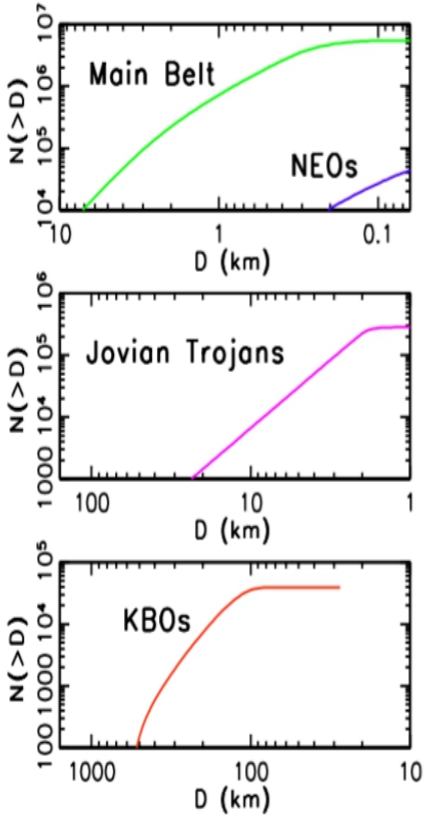


Figure 5.1: Cumulative counts of asteroids detected by LSST vs. size for dominant populations of Solar System bodies, as marked. The total expected numbers of objects detected by LSST are 5.5 million Main Belt asteroids, 100,000 NEAs, 280,000 Jovian Trojans, and 40,000 TNOs (marked KBO).

X

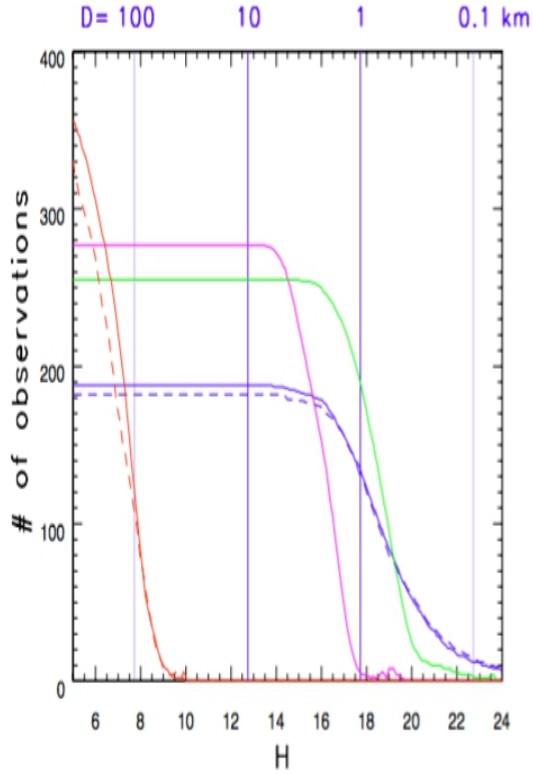
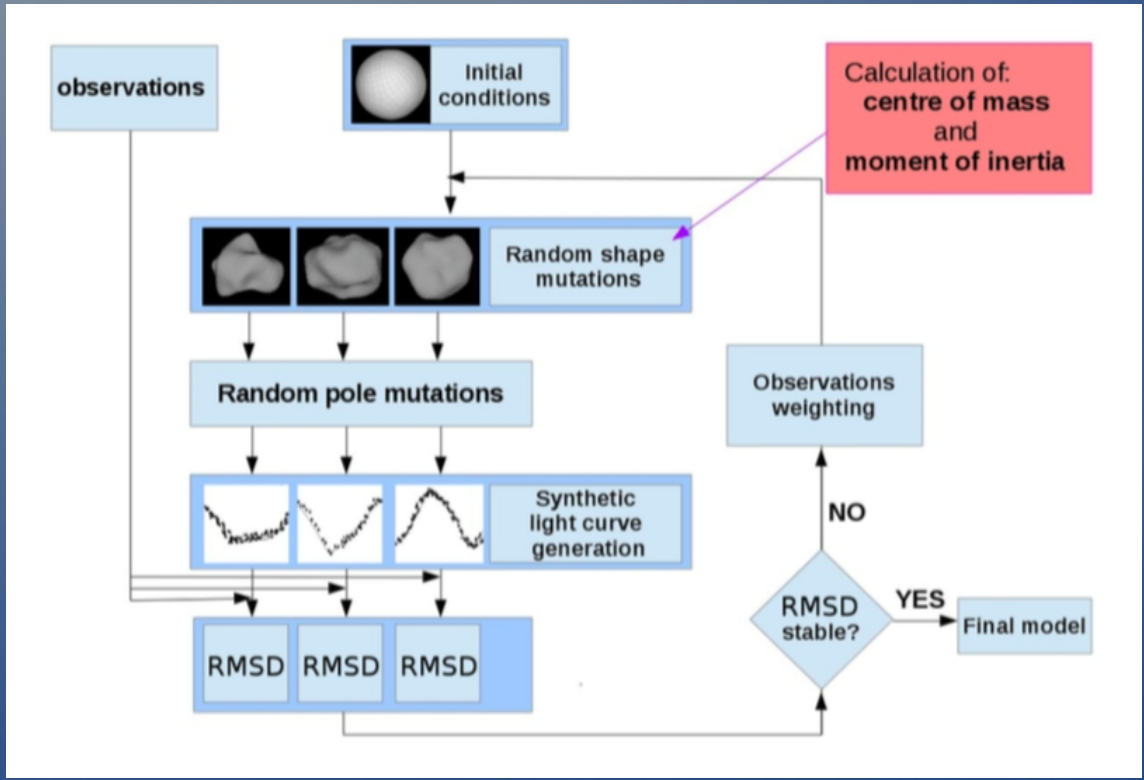


Figure 5.4: The median number of expected LSST detections of a given object as a function of H for dominant populations of Solar System bodies. Solid lines correspond to classical TNOs (red), Jovian Trojans (magenta), MBAs (green), and NEAs (blue). The red dashed line corresponds to Scattered Disk Objects, and the blue dashed line to PHAs. Nights with only one detection are not counted.

Shaping Asteroid Models Using Genetic Evolution (SAGE)

Bartczak, P.; Dudziński, G. 2018 MNRAS



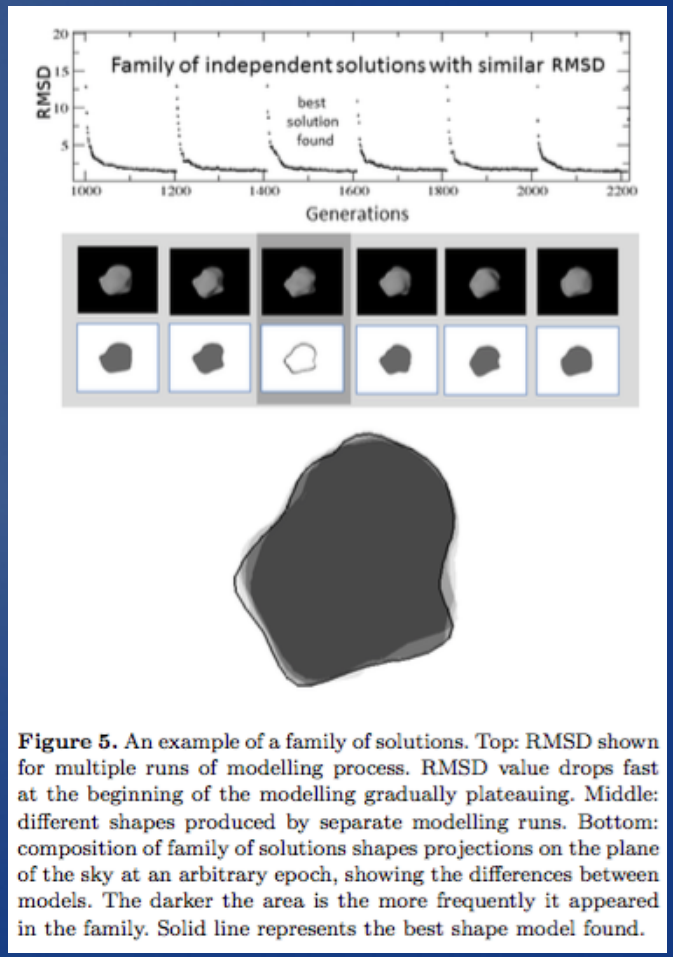


Figure 5. An example of a family of solutions. Top: RMSD shown for multiple runs of modelling process. RMSD value drops fast at the beginning of the modelling gradually plateauing. Middle: different shapes produced by separate modelling runs. Bottom: composition of family of solutions shapes projections on the plane of the sky at an arbitrary epoch, showing the differences between models. The darker the area is the more frequently it appeared in the family. Solid line represents the best shape model found.

Data + computing resources

- Small body and planetary ephemerides from the JPL
  - Large amount: 2-4 times/year. Must talk the JPL people
- Orbital elements from the Minor Planet Center
  - Less frequent and small amount of data – should be simple
- Astrometric measurements from Gaia
  - Necessary to have then locally
- SDSS and 2MASS photometry
  - Handy to have it locally, but maybe not necessary (Rodrigo?)
- LSST data: single epoch measurements
  - Mandatory - we deal with transient objects
- Resources
  - LIneA Jupyter notebook so far – but will not be enough soon