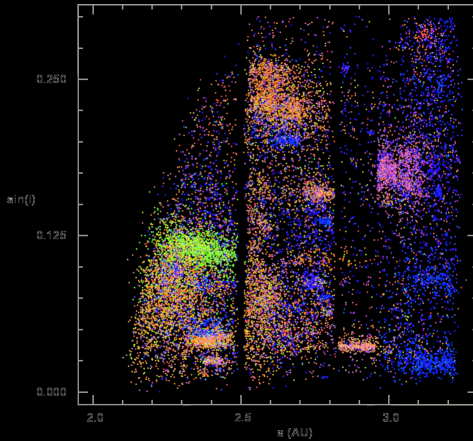


Distribution of asteroid compositions



SUMMARY.

Asteroids are the remnants of the original building blocks that formed the terrestrial planets. The early events of planetary migrations that occurred in our Solar System left their prints in the distribution of asteroid orbits and compositions.

While detailed compositions are determined from spectroscopy, multi-filter photometry from large surveys such as the SDSS or the LSST can be used to classify asteroids into compositional groups and study their distribution into orbital elements (see Figure on the left).

This METEOR combines theoretical knowledge with practical work (applicable to other research fields). It includes lectures on the composition of asteroids, their links with meteorites, their surface aging due to space weathering, and experimental work on the links between spectroscopy and photometry, and methods of classification

OBJECTIVES

- Develop codes in python. Convert spectra into photometry. Classify large samples into coherent groups. Extract essential information from articles.
- Acquire fundamental knowledge on asteroid compositions and their biased sampling by meteorites, space weathering, reflectance spectroscopy, and Solar System formation.

PREREQUISITES

Statistical physics, Dynamics and Planetology, Numerical methods

THEORY

by B. CARRY, P. TANGA & G. LIBOUREL

The theoretical part of the METEOR covers both fundamental knowledge on asteroids and on photometry/spectroscopy in astronomy.

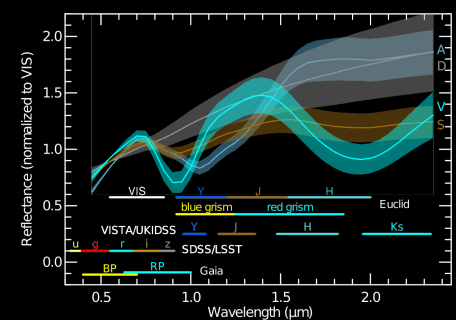
- Solar system formation. Accretion of planetesimals. Planetary migrations.
- Classification and composition of meteorites.
- Distribution of asteroids. Compositions and classification.
- Surface aging by space weathering.
- Definition of the magnitude systems in astronomy. Conversion between spectra and magnitudes.
- Extraction of asteroid signal in sky surveys.
- Measurement of asteroid reflectance. Solar analogs.

APPLICATIONS

by B. CARRY

The project reproduces all the steps used nowadays to conduct large scale study of asteroid compositions from sky surveys. The students will

- retrieve the photometry from on-line repositories,
- compute reference colors from templates for comparison,
- reduce the dimensions of the sample while minimizing information loss,
- classify asteroid in groups from their observed properties,
- interpret their orbital distribution.



MAIN PROGRESSION STEPS

- Once a week: theoretical courses (exam at end term).
- First half: exercices on photometry.
- Second half: asteroid classification numerical project.
- Last week: preparation of the final oral presentation.

EVALUATION

- Written examination (40%), project (40%), and comentary on an article (20%).

BIBLIOGRAPHY & RESSOURCES

- Review on the history of our solar system from asteroids composition:

DeMeo & Carry (2013, 2014).

- Chapters on [spectroscopy](#), [space weathering](#) [space weathering](#) from Asteroids IV book.

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