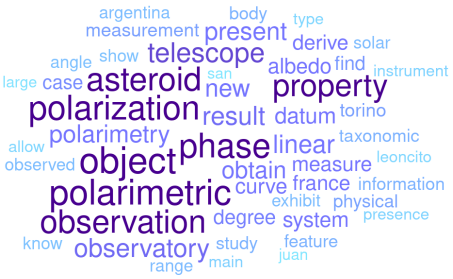
Asteroid Polarimetry: Observations and Data Analysis



SUMMARY.

Polarimetry is not the first observational technique coming to a Master student spirit. Moreover associated to the word asteroid it becomes more and more exotic. Nevertheless many information such as size, mineralogical type, surface physical structure can be obtained from the study through a polarimeter of Sun light reflected by an asteroid.
C2PU is involved since many years in such a research topic and has recently provide the largest data base on polarimetric data for asteroids (Bendjoya et al. 2022). Recently C2PU has began a new international collaboration (Finland, Gemany, Ireland and Italy) with a brand new polarimeter now installed (2023) at the Cassegrain focus of 1m telescope Omicron which performances open a major step forward in the characterization of fainter asteroids.
This METEOR will offer to the student(s) the opportunity to participate to campaigns of observation (if schedule @ C2PU permits), data reduction , data analysis and data mining to derive major physical information on asteroids.

— OBJECTIVES

- link polarization of reflected light to asteroid physical parameters
- understand the functioning of a polarimeter and all of its components
- perform polarimetric observations on sky
- reduce polarimetric data
- derive Stokes parameters from raw images
- analyze data
- build the relevant so called Pr=f(phase angle) curves from which albedo, diameter, mineralogical features... can be derived
- cross-match polarimetric catalogs with other asteroid physical parameter catalogs and make statistical analysis for sub group of asteroids.

— PREREQUISITES

The fundamental courses linked/coming in support to this METEOR are Electromgnetism (Licence lectures) and

☒ S1. Meteor C2PU

— THEORY

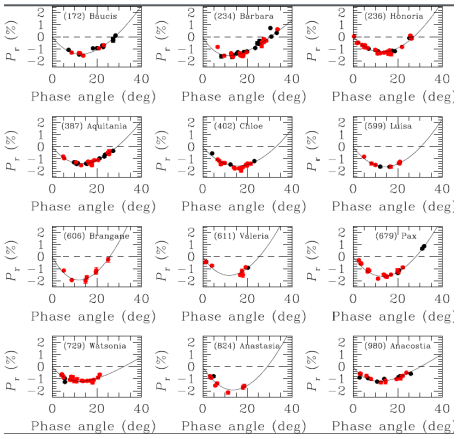
by Ph. Bendjoya

Polarization of reflected light, stokes parameters, physical parameters of asteroids, NEOs, dynamical families, asteroid mineralogy.

— APPLICATIONS

by Ph.Bendjoya

After an introduction to polarimetry and polarimeter as well as their interest in asteroid studies, students will perform polarimetric observations at C2PU (if the polarimeter commissioning coincides with the METEOR or will use archive data from C2PU polarimetry), will reduce data, extract stokes parameters, build the $P_r = f(\alpha)$ curves,develop some scripts (Python) and will exploit different databases.



— MAIN PROGRESSION STEPS

- First third period : theoretical courses (lectures, articles)
- Second third of the period : observation and reduction
- Third third of the period : exploitation of databases
- Last week : preparation of the final oral presentation.

— EVALUATION

- `Theory grade [30%]`
  - Presentation of an article (30%): critical spirit
- `Practice grade [30%]`
  - Project (70%): initiative, progress, analysis
- `Defense grade [40%]`
  - Oral and slides quality
  - Context
  - Project / Personal work
  - Answers to questions

— BIBLIOGRAPHY & RESOURCES

Any reference or web page that students can read to have a better idea of the topic.

- Bendjoya et al. 2022

— CONTACT

☎ +33.4.xx.xx.xx.xx
✉ bendjoya@oca.eu