

Gaia space mission and asteroid spectroscopy

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1. Introduction

The light of the Sun reflected by the surface of asteroids carries information about their *composition* [1, 2]. By dividing an astronomically observed asteroid spectrum by that of the Sun (or a solar analogue star) wavelength-by-wavelength, one derives the asteroid *reflectance spectrum* (*a.k.a. reflectivity*), which is diagnostic of the composition (Fig. 1). In order to enhance compositional interpretation, *taxonomies* of asteroid spectra have been developed (Fig. 1).

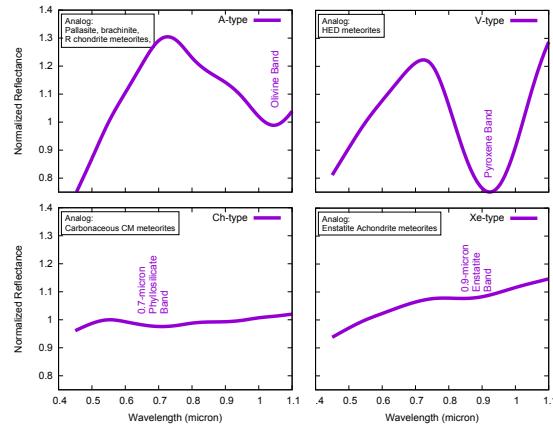


Figure 1: Average values of the reflectance spectra of A-, V-, Ch-, and Xe-types. Different types of reflectance spectra indicate different compositions. Adapted from ref.[2]

2. From BP/RP to asteroid reflectance

The visible-light spectra of asteroids is measured by Gaia using its Blue and Red photometers (BP and RP for short). (i) BP/RP epoch spectra are *internally calibrated*. (ii) Asteroids and solar analog stars are identified – amongst billions of stars – and their BP/RP calibrated epoch spectra are obtained from the Main

Database of Gaia observations. (iii) Average BP/RP solar analog is obtained. (iv) Epoch reflectance spectra are obtained by dividing the BP/RP epoch spectra by the average solar analog. (v) The average reflectance spectrum is calculated for each asteroid.

3. Classification

The average reflectivities of all asteroids observed by Gaia will be classified using an unsupervised clustering algorithm [3]. Comparison of Gaia spectra with those of known asteroid spectral taxonomies [4, 1] are performed.

4. Preliminary Results

We are currently validating asteroid reflectance spectra obtained from Gaia BP/RP. Figure 3 shows some of the BP/RP reflectancies compared to ground based spectra. Although the Gaia asteroid spectra shown here are based on a preliminary *cycle 1 calibration*, the agreement is very good.

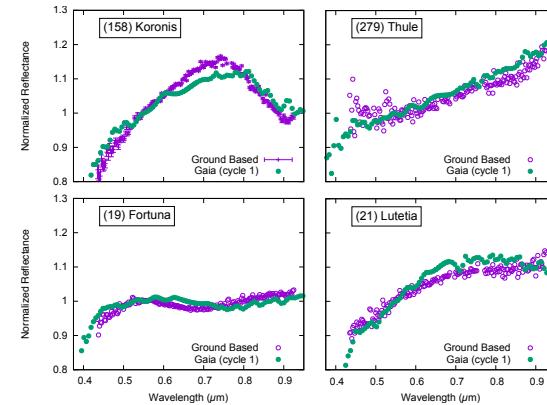


Figure 2: Gaia reflectance spectra of four asteroids with well known ground based spectra. The BP and RP data, which are calibrated independently, are merged in one single reflectance spectrum.

Acknowledgements

The Gaia asteroid spectra pipeline is run at the CNES in Toulouse, France.

References

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