# Spectro-polarimetry: New diagnostic tool for the characterization of small Solar System objects

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Asteroid polarimetry measures the fraction of linear polarization of sunlight scattered by asteroid surfaces at visible wavelengths. Most of the investigations so far have been focused on the variation of linear polarization in the $V$ band as a function of the phase angle (the angle between the Sun, the asteroid, and the observer). The observed curves of polarization versus phase angle may be used to derive the albedo of the objects (e.g., Cellino et al. 2012, and references therein).

Something that has been poorly studied until now is how polarization depends upon wavelength. Earlier studies of the dependence of linear polarization of an asteroid upon wavelength (Belskaya et al. 2009) suggested that, at larger phase angles, moderate-albedo asteroids exhibit lower polarization at longer wavelengths than at shorter wavelengths; whereas, at smaller phase angles, polarization increases with wavelength. Interestingly, low-albedo objects were found to exhibit the opposite behavior. If this is true, one single spectro-polarimetric measurement may be sufficient to distinguish between bodies belonging to different albedo ranges. This would be a tremendous improvement, because sampling the variation of the polarization as a function of phase angle requires to perform numerous observations over time intervals of several weeks. For this reason, the number of asteroids with an albedo reliably estimated via polarimetric observations is still fairly limited.

To test this hypothesis, we have performed a spectro-polarimetric survey of atmosphereless bodies of our solar system (to our knowledge, the first of its kind). We have discovered that asteroids exhibit a large variety of polarized spectra that may eventually lead to a substantial improvement of their classification and characterization. We have also compared our spectro-polarimetric observations with laboratory measurements of various inorganic and organic samples, to assess how spectro-polarimetric signals can be used as a diagnostic tool for astrobiological studies of our Solar System (Sparks et al. 2009; Sterzik et al. 2010, 2012).

Spectro-polarimetry is a very promising tool for the study of asteroids — yet virtually unexplored. Progressing from traditional broadband polarimetric measurements to spectro-polarimetry may have the same impact as upgrading from broadband photometry to spectroscopy and spectro-photometry.

**References:** Belskaya I., Levasseur-Regourd, A.-C.; Cellino, A., 2009, Icarus, 199, 97; Cellino, A. Gil-Hutton, R.. Dell'Oro, A., et al., 2012, JQSRT, 113, 2552; Sparks, W.B.,Hough, J., Germer, Th. A., et al. 2009, PNAS, 106, 7816; Sterzik, M., Bagnulo, S., Azua, A., et al. 2010, The Messenger, 142, 25; Sterzik, M., Bagnulo, S., & Pallé, 2012, Nature, 483, 64.