Spectral continuity in SDSS u'g'r'i'z' asteroid photometry

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The Sloan Digital Sky Survey Moving Objects Catalog (SDSSMOC, Izevic et al. 2002) provides magnitudes in u'g'r'i'z' bands (Fukugita et al. 1996) for 471,569 moving objects. For this large sample of numbered and unnumbered asteroids, as well as comets and other small bodies, it is possible to derive colors and, thus, broad-band photometric spectra in the visible. However, looking at the SDSS reflectance plots derived from the magnitude system, no sharp distinction are seen when superposing asteroid taxonomic types. The continuity through spectral slope and silicate band depth continues even when limiting the SDSSMOC dataset to the smaller-error observations. In the present work, we analyzed the behavior of the 4th release of the SDSSMOC in the Principal Component space (PC space) aiming to provide a scheme to discriminate between the diverse spectral behavior.

This scheme showed two alignments connected to the presence or absence of the 1-micron absorption band in the asteroid spectra. The first track corresponds to the variation in spectral slope of asteroids without the 1-micron absorption band. While the other track corresponds to an interchange in slope and silicate band depth, evolving from shallow and inclined spectra to deeper and flatter ones. We obtain linear equations for the two tracks, which are used to group the observations according to vicinity in the PC space.

In a final step, Carvano taxonomic groups (Carvano et al. 2010) were superposed in the PC space. This new method provides a tool to give a taxonomic characterization for observations that could not be classified by Carvano taxonomic scheme and to search for objects with unusual spectra.

References: Fukugita, M., Ichikawa, T., Gunn, J. E., et al. 1996, Astrophysical Journal, 111, 1748; Ivezi´c, Ž., Tabachnik, S., Rafikov, R., et al. 2001, Astrophysical Journal, 122, 2749; Carvano, J. M., Hasselmann, P. H., Lazzaro, D., & Mothé-Diniz, T. 2010, Astronomy and Astrophysics, 510, A43+.