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A study of the effects of faint dust comae on the spectra of asteroids

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Abstract

The presence of dust comae on asteroids and centaurs is a phenomenon that became accepted in the last decades and which challenges the traditional definitions of asteroids and comets. A possible way of improving the chances of discovery of Active Asteroids is to use large multi-colour surveys or catalogs, like SDSS Moving Object Catalog. In this work we analyze the effects of faint dust comae on asteroid spectra and then use it to investigate the effects that a faint dust comae would have over the spectrum, magnitude, and radial profile of asteroids.

1. Introduction

Seventeen asteroids of the Main Belt and three Near Earth Asteroids have shown cometary activity. These objects have been called Active Asteroids (AA) (Jewitt, 2012). The physical source of their activity can be diverse; among the possible causes are collisional and volatile sublimation processes. The detection of AA is determined by the presence of a coma in its photometry, nevertheless this coma could be so faint that it would be very difficult to detect it. In this work we study the influence of a faint coma over the asteroid in the spectra. This has already been suggested by Carvano et al. (2008) to the observe the atypical spectrum of the asteroid (5201) Ferraz-Mello and modeled by Carvano & Lorenz-Martins (2009) from which they were capable to produce a reflectance increase in shorter wavelengths, and shows that presence of a faint coma produces an unusual reflectance.

2. Summary and Conclusions

In our model, we study more realistic distribution of particle in comae formed by sublimation or collisional ejection. This allowed us to study different parameters that influence the formation of coma. The size distribution of particles in the coma, their optical properties, and the physical processes responsible for creating such distribution are complex and depend on many variables such that all this will influence the obtained result. From our model it is evident that a coma in the asteroid (Figure 1a-b) produces changes in the observed spectra (Figure. 1c), increase in the brightness (Figure. 1d) and modify the radial profile (Figure. 3). In the case of the spectra, other processes can also affect this in a similar way. However, one possible indicative of presence of coma would be the relative increase in the reflectance at the bluer end of the spectrum.

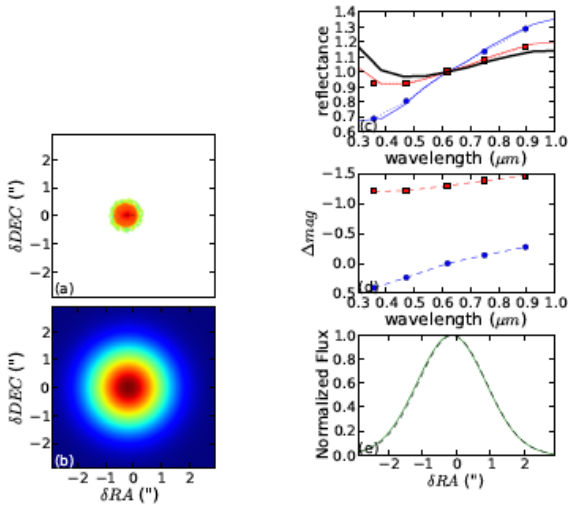

Figure 1: Reflectance normalized modeled at the central wavelength of the r filter for a total mass in the coma of $M_c = 10^6$kg and a phase angle of g = 6º, seen 3 days after ejection. (a) Brightness projected at the plane of sky; the intensity is shown with a logarithm colour map; (b) the same result, convolved with a PSF with 1 arcsec FWHM, shown using a linear colourmap. (c) Reflectance normalized at the central wavelength of the r filter. The reflectance

spectra of the asteroid without coma is shown in blue, the reflectance at the SDSS filters (obtained through convolution of the reflectance spectra with the filter band passes) are show as circles and connected with a dotted line. The reflectance spectra of only the coma is shown in black and the combination of the spectra of the asteroid and the coma is shown in red, with the reflectance at the SDSS filters shown as squares. ; (d) Difference of magnitudes between the asteroid (blue circles) and the asteroid in the presence of the coma (red squares), with the asteroid magnitude at the r filter as reference. (e) Radial profile of the normalized Flux at r filter convolved with a 1 arcsec PSF.

In conclusion, the model presented in this work allows a finer understanding of the observational consequences of faint comae that might be present around minor bodies of the Solar System. In this work is showed that often the sole indicative of the existence of such faint coma would be changes in the observed spectra. Even so, spectral variations alone cannot be considered proof of such phenomena. Instead, the type of spectral variations highlighted here can be use to refine the list of potential AA so that confirmations of the presence of comae through careful photometric monitoring of the candidates to identify sudden increases in the magnitude, and through efforts to detect extended profiles on images of those bodies.

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References

[1] Jewitt D. (2012) *AJ. 143,* 66.

[2] Carvano J. et al. (2008) *A&A., 489,* 811-817.

[3] Carvano J. and Lorenz-Martin, S. (2009) Proceedings of the International Astronomical Union, 5, 223-226.