Title: Distribution functions of asteroid physical properties

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Abstract: In this thesis, I utilize photometric data sparse in time produced by all-sky surveys and investigate physical properties of large asteroid populations. In principle, the individual approach to asteroid modeling cannot compass all objects because new asteroids are continually discovered and we do not have enough data for them. Therefore, in this work I present an essentially different, statistical approach. In a series of papers, we developed two independent methods which use a triaxial-ellipsoid approximation, and we test their applicability and limits. We prove they can be used to the photometric databases like Lowell Observatory database or Pan-STARRS. The output quantities are distributions of the spin axis directions and shape elongations for asteroid populations, and using the Kolmogorov-Smirnov test we search for differences among them. The main result of my work is that the distribution of ecliptical longitudes of spin axes is nonuniform. Moreover, this nonuniformity is more significant for asteroids with low orbital inclinations and the distribution is dependent on the shape elongation. We ran a number of simulations and tests, but we did not find a clear explanation of this enigmatic result. We found that small asteroids ($D < 25\,\mathrm{km}$) are on average more elongated than large ones. We also constructed distributions for 13 main-belt families; as to the distributions of spin axes latitudes, we found that Gefion family is significantly different from its background and when studying distributions of elongations, we found that Massalia and Phocaea have more elongated members than corresponding backgrounds.

Keywords: asteroids; sparse photometry; distributions; statistics