Distribution of spin axes in the asteroid population

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Currently, the main method for determination of shapes and spin states of asteroids is the inversion of their lightcurves (Kaasalainen et al., 2001). The all-sky surveys such as Pan-STARRS, Catalina Sky Survey and LONEOS produce a lot of photometric data, but these data are sparse in time (only few measurements per night). Although we can derive models from sparse data, this requires sufficiently many photometric measurements with good quality (errors < 0.1 mag). With currently available data, the success rate of getting a unique solution of the inverse problem is low. Therefore, we have developed an alternative approach that models asteroids as geometrically scattering triaxial ellipsoids. The model computes mean brightness and the dispersion of brightness for each observed apparition. The parameters are ecliptic longitude, latitude of the pole, and the ratio of axes of the ellipsoid. These parameters are optimized to reach the best agreement with observed mean brightness and dispersion of brightness. To test the reliability and accuracy of our approach we ran set of simulations with synthetic data based on the complex asteroid shapes from the DAMIT database and Hapke's scattering model. We will present the results of simulations with synthetic data and the distribution of poles derived from real data from the Lowell Observatory database and confront our results with the work Bowell et al. (2014), who used a similar approach and revealed the anisotropic distribution of spin-axis longitudes.

References: Kaasalainen, M., Torppa, J. & Muinonen, K. 2001, Icarus 153, 37; Bowell, E., Oszkiewicz, D. A., Wasserman, L. H., Muinonen, K., Penttilä, A., Trilling, D. E. 2014, Meteoritics & Planetary Science 49, Nr 1, 95–102.