Context: Slivan (2002) determined spin state of ten asteroids in the Koronis family. Surprisingly, all four asteroids with prograde sense of rotation were shown to have spin axes nearly parallel in the inertial space. All asteroids with retrograde sense of rotation had large obliquities and rotation periods either short or long. It was shown that Yarkovsky–O'Keefe–Radzievskii–Paddack (YORP) effect can explain all these peculiar facts. In particular, it drives spin axes of the prograde rotators to be captured in a secular spin-orbital resonance known as Cassini state 2. Vokrouhlický et al. (2002) dubbed these configurations "Slivan states".
Aims: A question arises whether Slivan states could exist also in other regions of the main asteroid belt, in particular its inner part, where observations are most easily obtained. Here, however, dynamical difficulties arise due to convergence of the proper frequency s and the planetary frequency s_6. We investigate possibilities of a long-term stable capture in the Slivan state in the inner part of the main belt.
Method: We used SWIFT integrator to determine orbital evolution of selected asteroids in the inner part of the main belt. In the case of 20 Massalia, we observed the asteroid in 2011, and used these new data to help better solve the rotation state using the lightcurve inversion method developed originally by M. Kaasalainen. Finally, we wrote and debugged numerical code, which is able to efficiently simulate secular evolution of the asteroid's spin axis. This tool is used to study stability of the Slivan states in the inner part of the main belt.
Results: We find that stable Slivan states can exist in the inner part of the main belt provided proper orbital inclination is small (e.g., the case of asteroid 20 Massalia). However, when the proper inclination value is too large, or the asteroid in the innermost part of the asteroid belt (Flora region), long-term stability of the Slivan states is impossible.