Inner Main Belt V-type asteroids as tracers of differentiated planetesimals

Asteroids are small rocky bodies orbiting the Sun mainly between orbits of Mars or Jupiter in the so-called Main Asteroid Belt. Asteroids are also remnants of planetesimals - planet emproys that existed in the Solar System. Meteorites are asteroid fragments, that have been freed by collisions from their surfaces, entered Earth collision trajectory, survived the passage through the atmosphere, and have been collected on the Earth's surface.

The diversity of iron and basalt meteorites indicates the existence of 30 to 150 differentiated (similarly to our Earth's geological layers: iron core, silicate mantle and crust) planetsimals. Among asteroids we observationally identified only one large asteroid (named 4 Vesta and its fragments) and four smaller as chunks of different planetsimals, which does not add up to expected 30-150 planetesimals. This difference between abundant evidence in the form of meteorites and the lack of a sufficient number of asteroids is known in planetology as the missing mantle problem.

One possible solution is that the differentiated planetsimals formed closer to the Sun, in the region of Earth-like planets, where the accretion occurred quickly and even small planetsimals could differentiate. They were later disrupted into smaller pieces and scattered into the current Main Asteroid Belt. This hypothesis predicts an abundance of V-type (basaltic) asteroids in the inner region of the Main Belt. In this project we will observationally test the theoretical existence of a V type asteroid other than the chunks of Vesta in the inner region of the Main Belt. We will make telescopic observations and determine the physical parameters (spin axis orientation, sense of rotation, shape, and mass) of a large number of asteroids in the inner Main Belt. Additionally, with the help of numerical simulations we will trace their past trajectories. This will allow us to determine the location of the different planetsimals and their masses in the solar system.

Comparing these results with other planetary systems in which asteroid belts have been detected will allow in the future to create a more complete model for the formation of planetesimals and planets.