New asteroid taxonomy as a tool to understand composition of planetary systems

One of the hot topics of modern astronomy is a question about the existence of life in the Universe. This problem is usually discussed in relation to the origin and evolution of life on Earth comparing the properties of the newly discovered extra-solar planets with those in our Planetary System. One of the challenges set for the modern theories of the formation of planets is explanation of the physical characteristics of asteroids, which are building blocks from which the Earth and other planets were created long ago. The aim of the project is to use the enormous amount of observational data to work out a new map of the distribution of asteroids in the Solar System depending on their surface properties. Those properties are related to mineralogical composition of the surface and its structure (smooth, coarse, covered with sand or pebbles) and are used to divide asteroids into different groups called taxonomic classes.

To analyze observational data modern numerical methods will be used. They are similar to the methods used by Google and Facebook to analyze the habits of users of internet from the huge amount of data left by them in the net. As it is known, both firms are able to learn the preferences of different groups of people depending, among all, on their place of residence. In a similar way in the project different groups of asteroids will be characterized based on their location in the Solar System. Result may later be used to verify theories of the origin of the Solar System planets and their application to evolution of the extra-solar planets.

Apart from testing theories of planetary origin, asteroid taxonomy can be used to connect different types of asteroids with different types of meteorites studied in laboratories. As meteorites are pieces of rocks ejected from the asteroids, relating them in a precise way to specific asteroid taxonomy classes will make it available to learn the properties of asteroids – without sending to them space probes.

The knowledge of the mineralogical properties of asteroids is becoming important also for the industry. There are several enterprises which plan mining valuable minerals from those asteroids, which are closest to Earth. We are not talking here about iron or copper, but about the so called rare earth elements which are indispensable for production of modern electronics. Serious discussions are also carried on about extracting hydrogen which is the main component of rocket fuel. In the near future asteroids could become mines and filling stations for space installations – assuming we will learn well their properties.

Another example of of application of the accurate asteroid taxonomy is the defense of Earth from collisions with those bodies, which move close to our planet. Despite a relatively small probability of such an impact there are efforts to develop technologies of orbit changes or even disruption of those bodies into pieces. The knowledge of asteroid taxonomy is necessary in such works.