

Goals, technique and equipment of meteor study in Russia

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Abstract

Institute of Astronomy RAS is one of the science institutes in the Russian Federation providing systematic optical meteor observations and supervises several meteor groups in our country. The main tasks of our investigations are dedicated to study meteoroid nature as well as meteoroid streams and meteoroid population in the Solar System.

In the XXI century we in Russia carry out the reconstruction of our meteor astronomy due to possibilities of new meteor observation equipment (more powerful than were used before as visual and photographic methods) had made possible to select more interesting goals.

First of our task is investigation of meteoroid streams crossing the Earth's orbit, and character of meteoroid distributions along of them. The multi stations meteor monitoring from located in the both hemispheres of the Earth can help in this study. According to the analysis of the evolution of meteor orbits, the compact and long lived meteoroid streams consist mainly from large particles. The observation equipment (cheap TV-cameras) with low limiting magnitude we use for gathering observational data.

On the other hand, the observations of weak meteors are needed for new meteor shower indication (or confirmation of known meteor shower). The more effective way to do it is comparison of individual meteor orbits parameters (then calculation of radiant of meteor showers). The observations of space debris (as the meteors with low velocity – less 11.2 km/s) can be taking up within this task.

The combination of high sensitive TV-cameras WATEC and super-fast lenses COMPUTAR are widely used for meteor TV-monitoring. The TV-systems for round-year meteor observations are fixed and are permanently oriented to the zenith area (the patrol camera – PatrolCa). The mobile TV-cameras (MobileCa) are used for double station observations (if it is possible) and located not far from main cameras PatrolCa (20-30 km). The mobile TV-cameras observe 90% of main PatrolCa cameras

FOV at altitudes of meteor events. All our cameras are adapted to the Russian climate (the camera's box has heater and has lid to cover input window at bad weather conditions). The PatrolCa in the Zvenigorod Observatory of the Institute of Astronomy RAS, for example, is working in automatic mode (the observer can operate it using Internet connection) [1]. As the MobilCas are not working in automatic mode, observers have to control them every night. The PatrolCa and MobilCa have fields of view 50°x40° and the limiting magnitude up to +6.0 for stars at 25 frames/s mode.

The second important task of our investigations is estimation of meteor particles masses. The light flux of meteors and their velocities should be measured accurately for this purpose. Every our TV-meteor registrations can be processed by special program to obtain these values.

The third task of the meteor astronomy is the evolution studying of meteor showers. A non-gravitation particle drift depends on its mass, and so depends on its brightness. Evidently, to estimate such drift we need to compare orbital parameters both for bright and weak meteors from the same shower. The observational data of weak meteors, but not weaker then +9m ÷ +10m seem to be necessary for investigations of the dynamics of meteor showers.

The TV-cameras with extremely high sensitive are needed for such observations. During 2006-2009 a unique TV-camera FAVOR [2] was used for meteor observations. It was a hybrid TV-camera with intermediate image intensifier, that compressed images several times, so effective ratio was $F/D=0.2$ at field of view above 20° (no ordinary optic allow it). FAVOR does not work since July 2009. Therefore the camera with high quality lens CANON EF85 mm f/1.2 and SONY matrix ICX285 was designed for our meteor observations. The limit of magnitude of this camera is not much different from the PatrolCa and MobilCa cameras

The important observation data were obtained with FAVOR camera. 13282 meteors brighter then +7m (that were 100% detected by special software were selected to exclude one-frame meteor tracks) were

registered until June 2009. The results of analysis of these observations are presented.

The observations with PatrolCa as well as MobilCa are provided also. More than 1000 meteors of the PatrolCa were detected from July 2012 until present day. Observations were carried out by both single station and double station methods. The results of these observations are presented. The double-station observations were targeted to the determination of individual orbits of observed meteors. Data of the monitoring shows that at least 40% of sporadic meteors may be referred to catalogued weak meteor showers.

The review of the technique and equipment of meteor optical observations in Russia were presented.

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References

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