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THE NEW METHOD OF PROCESSING DATA ON METEOROIDS USING MODERN OBSERVATIONS

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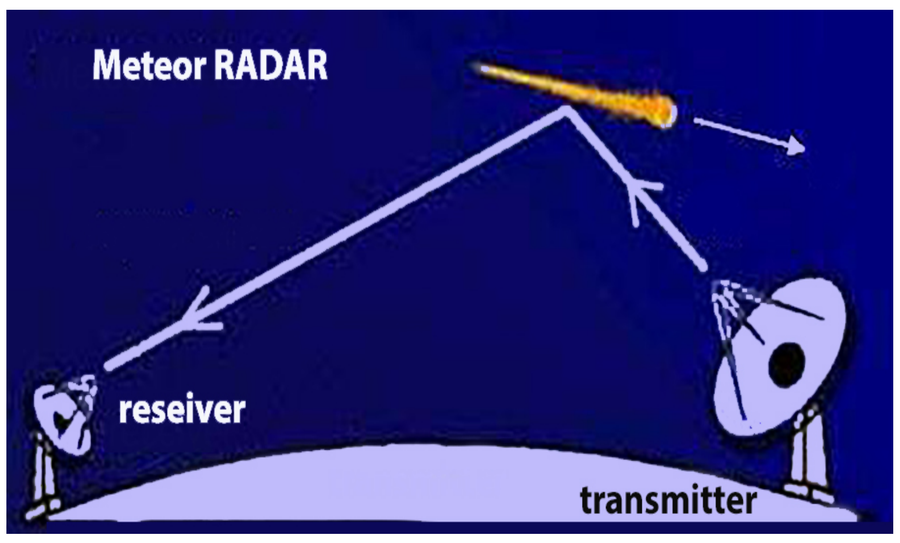

Introduction

The work focuses on the reduction of modern observations of meteoroids from the databank formed both by professional researchers and by amateur astronomers. The new method of processing the modern observations of meteoroids, which provides comparable with the radar observations results, was developed at Engelhardt astronomical observatory (EAO) on the basis of modern physical theory of meteoroids. Due to the fact that the accuracy of the new method of modern observations processing has significantly increased, it is possible to process the modern observations of the Perseids and Leonids over a period of 120 years.

Methods

The physical theory of meteors was used in this study. Its application allowed to explain the observed at 2 MHz height distribution of meteor echoes, in which the upper part of the distribution relates to the heights of 140 km [1], for the first time. The instrumental methods of observing meteoroids were successfully developed in Kazan, and several interesting studies have been conducted. The orbit evolution of the two major meteor showers Geminids and Quadrantid, which were intensively observed at the EAO, was investigated and the possibility of the Quadrantid's genetic connections with comets 1860 I, Tuttle, Pons-Broocks, Stephan-Oterma, and Kosik-Peltier [2] was considered. The orbits of meteor showers that formed Bootid and Bielid streams [3] were studied as well. the Perseids meteor shower's orbit and its relationship to the matter ejection by the comet 1862 III Swift-Tuttle were investigated [4]. In this regard, the comet Grigg-Skjellerup was investigated as well. It is a periodic Jupiter-orbiting comet which at the same time passes near the Earth and is of great interest for researches dealing with comets. In 1967 the distance between it and Earth was estimated to be 0,003 AU. The meteor shower had therefore been expected and was actually observed [5].

Results

As a result, the role of Jupiter extends beyond the comet. In this connection, close approaches with it will lead to a change in the radiant of the shower, and if the ejection from the nucleus continues, there will be almost simultaneously observed from 2 to 3 showers differing by 10° and 20° in declination. It is found that since 1874 the Perseids' activity has increased fourfold and solar longitude corresponding to the maximum of activity has not changed. The activity of the Leonids has not changed over this period, but solar longitude at maximum of activity has linearly increased, and this increase is 2,6° over 120 years. All of these discoveries for both showers relate to the stable periods only, but the parental comets of these streams –Swift, Tuttle, and Tempel-Tuttle – are far from the ecliptic plane. A method of determining the density of meteor shower on the basis of radio observations was developed [6]. EAO scientific group developed a new "tomography" method of calculating the sporadic meteor density distribution on the celestial sphere using radar observations of the meteors at the same station with a goniometer. The method allows calculating the shower density on the celestial sphere with an angular resolution of 2°. Another major scientific achievement of the meteor studies conducted in Kazan is the proof that the distribution of the shower density of meteoroids on the celestial sphere has two planes of symmetry: the first one coincides with the plane of the ecliptic, the other one is perpendicular to the first one and passes through the apex and antiapex of the Earth [7]. This is explained by the fact that meteoroids moving on orbits with the same a, e, i have the even distribution of the argument perihelion ω.

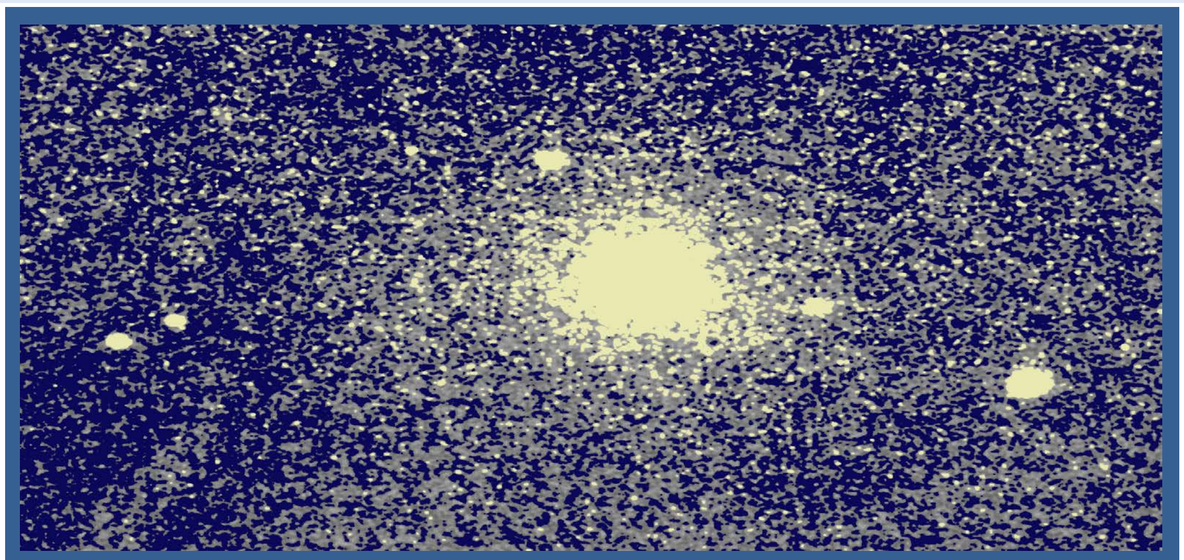

Fig.1 Grigg-Skjellerup comet

Conclusion

Currently, Kazan specialists in the field of meteor astronomy continue their studies, advise on organizing and conducting the processing of observations of meteors provided by the International Meteor Organization (IMO), and arrange the school for young observers both at Kazan Observatory and abroad in Belgium and England [8, 9]. The research topics have also been expanded from simulating the formation of a shower to the study of gravitational and non-gravitational perturbations from a parental comet and meteoroids on the basis of comparison with a given shower's structure observed [10].

Acknowledgements

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