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**METHODS AND INSTRUMENTS
IN ASTRONOMY: FROM GALILEO
TELESCOPES TO SPACE PROJECTS**

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ABSTRACT BOOK

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sometimes they can give very different values of distance for the same pair of orbits.

The most recent D -criterion is that introduced by Valsecchi, Jopek & Froeschle (1999). This function is the most transparently based on the physical difference between orbits. It is based on geocentric parameters, which are near-invariants for those orbits for which it is possible to find own elements. The same calculation as shown in the figure has been made for other distance functions. A conclusion, which can be made out of comparison of the criteria is that one type of orbits is better divided by one criterion, while another – by another. And sometimes it is necessary to use several criteria to be more sure that orbits of considered objects are connected.

MASSES OF ASTEROIDS 10 HYGIEA AND 152 ATALA

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Masses of asteroids 10 Hygiea and 152 Atala were determined using observations of perturbed asteroids (PA) since 1900. PA were considered as test particles. Calculations were fulfilled using two independent programs however models of motion and the observations were the same. PA were selected in accordance with the errors of the mass values of perturbing asteroids. Gravitational perturbations from all of major planets and Pluto were taken into account in the equations of motion of the asteroids. The coordinates of the perturbing bodies were calculated using DE405 ephemeris. The relativistic perturbations from the Sun and perturbations from Ceres, Pallas and Vesta or from 307 asteroids were also included into the model of motion. The erroneous observations were excluded in accordance with the criterion 3σ and application of the robust regression. The final mass values were obtained in common solutions using observations of all selected PA for each perturbing asteroids. The LMS was used to fit conditional equations. Two variants were considered: all observations were supposed 1) to have equal weights and 2) weight $1/\sqrt{2}$ was fixed for observations before 1950.

Our results show the appreciable contribution of the different sets of perturbing bodies on the mass values of 10 Hygiea when perturbed asteroids 20, 111, 1287, 1965, 13266 were used. The estimations of

contribution of Yarkovsky effect into the mass values of 10 Hygiea and 152 Atala were obtained for some PA. One should note in some cases strong correlation between corrections to mass values and values of acceleration due to Yarkovsky effect.

The mass of 10 Hygiea is equal to $(4.07 \pm 0.10) \times 10^{-11} M_{\text{Sun}}$, mean density is equal to 2.0 g cm^{-3} . Observations of PA 20, 3946, 6143, 11215, 15187, 24433, 48499, 113976 were used for this solution.

For asteroid 152 Atala, the mass value $(1.00 \pm 0.26) \times 10^{-11} M_{\text{Sun}}$ was obtained using observations of PA 250, 264, 651. Taking into account its diameter (287 km), the mean density is equal to 2.8 g cm^{-3} .

APPLICATION OF THE EMCCD CAMERAS FOR OBSERVATION OF AURORA AND NIGHTGLOW IN ARCTIC RESEARCH

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The optical instruments based on the EM CCD cameras for optical observations of aurora and nightglow are under discussion. This kind of measurements is widely used in the Polar Geophysical Institute (Russia); Institute of Space Physics and Royal Technological Institute (Sweden); Oulu University and Finnish Meteorological Institute (Finland); HAARP, Geophysical Institute University of Alaska and others in the USA. The main part of the report is a description of equipment and methods used in the Polar Geophysical Institute (PGI) at Kola Peninsula and Barentsburg (Spitsbergen). PGI uses EM CCD cameras of the Princeton Instruments.

PhotonMAX EMCCD camera is designed to be a no-compromise EMCCD camera for ultra low-light level imaging applications. This camera utilizes a 512×512 -pixel, back-illuminated EMCCD with $>90\%$ quantum efficiency and $< 1 \text{ e}^-$ rms read noise, achieving this high-QE, low-noise performance at faster-than-video frame rates. This groundbreaking technology comes equipped with a durable vacuum guaranteed for the lifetime of the camera. There were constructed several devices for field measurements using this camera.

The **All-sky image camera** permits to register temporal and spatial auroral variations in the dynamic range 16 Mb with time