POTENTIAL OF MCP BASED PHOTODETECTING SYSTEMS FOR HIGH ACCURACY ASTRONOMICAL OBJECT'S OBSERVATION

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An ideal receiver of radiation should record the arrival time and coordinates of each incoming photon. Available CCD arrays (accumulation mode) and microchannel plate detectors (photon counting mode) are mere approximations to the ideal configuration.

Reagent R&D Center has developed with its own technology a range of MCP based photodetecting systems (PDS) which give simultaneous recording of the coordinates and time of arrival of individual photons. A counting rate of 10^6 events per second, and a spatial resolution of 100 lines per mm have been achieved owing to a special geometry of the readout system – so called "coded collectors". The coordinate reconstruction algorithms involve a rough evaluation of the position of the electron avalanche and an accurate calculation of its center of gravity. In comparison with the MAMA detector, the present system uses more sophisticated algorithms but a simpler electronics.

The information on a point object (star) is a track in the (x, y, t) space both in a guiding mode and in a scanning over the celestial sphere. An analysis of the time coordinate enables an algorithmic evaluation and the elimination of an a priori unknown blur of the image that can occur, for example, due to vibration of the instrument.

A special software package and a supporting mathematical model have been developed to tailor the PDS to the recording of fast processes (high-speed spectroscopy and photometry) and also to high-accuracy astrometric experiments and to the recording of faint objects. The new approach to the processing of time-coordinate information enables an efficient use of MCP based PDS as detectors in space astrometric experiments.

E. Høg and P. K. Seidelmann (eds.),
Astronomical and Astrophysical Objectives of Sub-Milliarcsecond Optical Astrometry, 366.