A study of PSR 0531+21 light curve with 6.6 us temporal resolution

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The results of the Crab pulsar observations with the APD avalanche diode photon counter using the 6-meter BTA telescope of the Special Astrophysical Observatory are presented. The observations we performed in November 2003 in the framework of the multi-frequency synchronous observational campaign.

The folded light curve has been constructed by two different methods, using the Jodrell Bank Crab pulsar Timing Ephemeris and using the Fast Folding Period Search method employing only data of optical observations.

Both methods gave the 10^{-11} s accuracy of period determination, which corresponds to 2×10^{-4} precision of photon phases. This allows us to obtain the light curve folding with 6.6 us temporal resolution.

The analysis of the folded light curve shows the presence of some structure in the main pulse peak, which may be interpreted either as an absorption with a 30 us width and 1% amplitude on the smooth peak profile (3.9σ significance level) or as a flat emission-like feature with 0.5% amplitude and 70 us duration (5.9σ significance level). The results may indicate the presence of a small-scale structure of the optical emission region in the magnetosphere, which may be used for constraining models of pulsar emission.

Of course, the presence and parameters of such a small-scale structure of the main pulse ought to be confirmed in future observations.