The Shapiro effect as a possible cause of low-frequency timing noise of pulsars in globular clusters

T. I. Larchenkova, S. M. Kopeikin

The low-frequency (LF) timing noise contaminates residuals of time-of-arrivals (TOAs) of pulsar radio signals on long time intervals and in some cases can be explained by external astronomical factors not intrinsically related to the pulsar itself. A number of millisecond pulsars located in globular clusters show the LF noise that is present in their rotational phase. We discuss a possible origin of this noise as caused by random time variations in the Shapiro time delay produced by stars of the globular cluster passing near the pulsar line of sight. The Shapiro time delay is integrated over space of parameters characterizing a statistical ensemble of stars in a globular cluster and its long-term indeterministic time variation is obtained. We use this result for numerical simulation of the autocovariance function of the LF timing noise and show how it can be used for measuring the density distribution over globular clusters.