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Time Correlated Bursts in the Texas Helimak

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The turbulence in magnetically confined plasmas exhibits certain universal properties with the presence of coherent high-density structures, generically called bursts. These structures propagate convectively and, therefore, have a relevant impact on the plasma confinement. In the classical Stochastic Pulse Train Model (SPTM), it is considered that bursts appear randomly, therefore, the interval time between them should follow an exponential distribution. But in a recent study, it was observed that when a positive bias is applied during shots in the Texas Helimak, a simple toroidal plasma device, in addition to have an increase in the number of detected bursts, it was also shown that there is a time correlation between successive bursts and it was proposed that it should follows a gamma distribution, with parameters of shape, k, and scale, s, which relate to the time interval between successive pulses,τ, by $\overline{\tau} = ks$ with variance $V_\tau = ks^2$. The evidence of this correlation can be seen as a presence of peaks in the histograms of time interval and, also in the Power Spectrum Density of Ion saturation current fluctuation obtained by Langmuir probe, as well in the conditional average of bursts. Moreover, it has been noticed through simulations that there are two types of pulses regimes acting on plasma, one is the time correlated pulses whereas the other is the uncorrelated pulse background.

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