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Cooperation-induced temporal complexity in networks of pulse-coupled units ELVIS GENESTON, La Sierra University, PAOLO GRIGOLINI, University of North Texas — We study a network of stochastic pulse-coupled units generating bursts with the same size distribution as the neuronal avalanches in mature cultured neurons, recently revealed by the experimental observation. We prove that in addition to this form of complexity this model yields a form of phase transition generating also temporal complexity. This means that the distance from two consecutive bursts fits the prescription of a Mittag-Leffler (ML) function renewal theory. There exists a critical value of the cooperation parameter at which this description applies to the whole time regime. By increasing the cooperation parameter the ML theory breaks down and the sequence of bursts tend to become periodic with the same intensity. We make the conjecture that the analysis of this model may shed light into the theoretical foundation of neuronal burst leaders and that the recently discovered principle of complexity management may be conveniently applied to the neuro-physiological processes that are properly described by this model.

Elvis Geneston
La Sierra University

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