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Synaptic weight distribution under spike-timing dependent plasticity CHUN-CHUNG CHEN, DAVID JASNOW, University of Pittsburgh — We consider a network of integrate-and-fire neurons with random connections driven by noise triggered firings. The synaptic weights between the neurons are allowed to evolve under spike-timing dependent plasticity rules with additive potentiation and multiplicative depression. Under realistic physiological parameters, the network was equilibrated with simulations for a physical time of days. For lower potentiation-to-depression ratio $w^\star$, the synaptic weights forms a unimodal distribution which decays for large weights following a power law with a strong negative exponent. The decay exponent increases with $w^\star$, and runaway synaptic weights were observed as the exponent approaches -1. In the stationary state under the plasticity, for low $w^\star$, triggering the firing of a single neuron in a quiet network typically leads to a bursting event that lasts for seconds in a small network of 32 neurons. For high $w^\star$, the induced activities can persist in the network indefinitely. A mean-field theory combined with a master equation describing the distribution of synaptic weights predicts a power-law regime under the small jump assumption of synaptic weight changes. The exponents of predicted power law depends on the deviation of the mean synaptic weight from the $w^\star$ parameter and is to be determined self-consistently.

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