



سمینار هفتگی گروه ماده چگال نرم

## **The properties and impact of ion channel noise in single neurons**

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The variety of ion channels dispersed throughout neuronal membrane allows neurons to perform non-linear operations on input from pre-synaptic neurons. However, individual ion channels open and close stochastically and consequently produce voltage fluctuations that can impact the computational capabilities of single neurons. We measured these intrinsic fluctuations in cultured hippocampal neurons at the soma and calculated the current and voltage power spectra. By introducing pharmacological blockers and varying the membrane holding potentials, we were able to discern the contribution of different channels. Our observations were matched with predictions from kinetic models based on Markov chains, using a compartmental cylindrical model of a neuron. Similar models allowed us to extend the predictions to synaptic noise spectra in recordings of pyramidal neurons from neocortical brain slices. Finally, we performed Monte-Carlo simulations of the channel fluctuations, to study the impact of stochasticity on the forward and backward propagation of action potentials in neuronal dendrites. We found robust propagation in most regimes, but predict susceptibility to intrinsic noise for computations involving calcium spikes.

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قطب ماده چگال و سیستمهای پیچیده