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The Power Spectrum of Ionic Nanopore Currents: The Role of Ion Correlations MIRA ZORKOT, RAMIN GOLESTANIAN, DOUWE BONTHUIS, University of Oxford — Measuring the ionic current passing through a nanometer-scale membrane pore has emerged over the past decades as a versatile technique to study molecular transport. These measurements suffer from high noise levels that typically exhibit a power law dependence on the frequency. A thorough theoretical understanding of the power spectrum is essential for the optimisation of experimental setups and for the use of measurement noise as a novel probe of the nanopore's microscopic properties. We calculate the power spectrum of electric-field-driven ion transport through nanopores using both linearized mean-field theory and Langevin dynamics simulations. With only one fitting parameter, the linearized mean-field theory accurately captures the dependence of the simulated power spectrum on the pore radius and the applied electric field. Remarkably, the linearized mean-field theory predicts a plateau in the power spectrum at low frequency f, which is confirmed by the simulations at low ion concentration. At high ion concentration, however, the power spectrum follows a power law that is reminiscent of the 1/f dependence found experimentally at low frequency. Based on simulations with and without ion-ion interactions, we attribute the low-frequency power law dependdence to ion-ion correlations

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