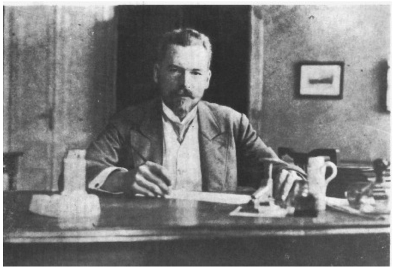

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Errors in Energy Landscapes Measured with Particle Tracking

Thursday, 6 September 2018 15:00 (3 hours)

Tracking Brownian particles is often employed to map the energy landscape they explore. Such measurements have been exploited to study many biological processes and interactions in soft materials. Yet video tracking is irremediably contaminated by localization errors originating from two imaging artifacts: the "static" errors come from signal noise, and the "dynamic" errors arise from the motion blur due to finite frame-acquisition time. We show that these errors result in systematic and nontrivial biases in the measured energy landscapes. We derive a relationship between the true and the measured potential that elucidates, among other aberrations, the presence of false double-well minima in the apparent potentials reported in recent studies. We further assess several canonical trapping and pair-interaction potentials by using our analytically derived results and Brownian dynamics simulations. In particular, we show that the apparent spring stiffness of harmonic potentials (such as optical traps) is increased by dynamic errors but decreased by static errors. Our formula allows for the development of efficient corrections schemes, and we also present in this work a provisional method for reconstructing true potentials from the measured ones.

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