Abstract Submitted
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Dynamics of Microtubule Growth and Catastrophe[1] SIDNEY REDNER, Boston University, TIBOR ANTAL, Harvard University, PAUL KRAPIVSKY, Boston University, MITCH MAILMAN, BULBUL CHAKRABORTY, Brandeis University — We investigate a simple dynamical model of a microtubule that evolves by attachment of guanosine triphosphate (GTP) tubulin to its end, irreversible conversion of GTP to guanosine diphosphate (GDP) tubulin by hydrolysis, and detachment of GDP at the end of a microtubule. As a function of rates of these processes, the microtubule can grow steadily or its length can fluctuate wildly. In the regime where detachment can be neglected, we find exact expressions for the tubule and GTP cap length distributions, as well as power-law length distributions of GTP and GDP islands. In the opposite limit of instantaneous detachment, we find the time between catastrophes, where the microtubule shrinks to zero length, scales as e^{λ}. We also determine the size distribution of avalanches (sequence of consecutive GDP detachment events). We obtain the phase diagram for general rates and verify our predictions by numerical simulations.

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Sidney Redner
Boston University

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