

Abstract Submitted
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Measurement of spatio-temporal transport in live cells RU WANG, ZHUO WANG, Beckman Institute, Univ. of Illinois at Urbana and Champaign, LARRY MILLET, MARTHA U. GILLETTE, Dept. of Cell and Developmental Biology, Univ. of Illinois at Urbana-Champaign, GABRIEL POPESCU, Beckman Institute, Univ. of Illinois at Urbana and Champaign — The live cell is a highly dynamical system with complicated biophysical and biochemical processes taking place at diverse spatiotemporal scales. Though it is well known that microtubules and actin filaments play important roles in intracellular transport, their dynamic behavior is not entirely understood. We propose a unified approach to studying transport in live cells. We used Spatial Light Interference Microscopy, a quantitative phase imaging method developed in our laboratory, to extract cell mass distributions over broad spatiotemporal scales. The dispersion relations for this transport dynamics, i.e. frequency bandwidth vs. spatial frequencies, reveal deterministic mass transport at large spatial scales ($\omega \sim q$) and diffusive transport at small spatial scales ($\omega \sim q^2$). At submicron scales, we observed a $\omega \sim q^3$ behavior, which indicates whip-like movements of protein filaments. Further control experiments where both the microtubule and actin polymerization were blocked suggests that essentially actin governs the long spatial scales behavior and microtubules the short scales. This label-free method enables us to access different components of cell dynamics and quantify diffusion coefficients and speed of motor proteins.

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