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Axonal Transport with Attachment and Detachment to Parallel Microtubule Network

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Abstract: We present a mathematical framework to analyze the intracellular transport inside an axon. Our model captures the spatial dynamics and interactions of motor and cargo through a system of coupled stochastic differential equations. Using the techniques of asymptotic analysis, the first passage time for the reattachment of a tethered motor is computed. Through the application of renewal-reward theory we are able to derive the key quantities of interest for the transport processes spanning over multiple attached and detached phases of a single molecular motor and cargo complex.