Comparison and Analysis of Stochastic Simulation Techniques for Near-Threshold Microlasers

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We compare two stochastic simulation methods, Fixed Time Increment (FTI) and Gillespie's First Reaction Method (FRM), in modeling near-threshold microlasers. A notable divergence between the two methods is identified, attributed to photon burst phenomena. While FRM proves to be computationally more efficient due to its lack of reliance on a constrained small timestep, we surprisingly discovered that the impact of this timestep constraint on the FTI simulation results is relatively minor. Our findings contribute to the optimization of stochastic simulation techniques in quantum photonics research.