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Title: Stochastic methods for diffusion-reaction simulations of irradiated materials

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Stochastic methods are widely employed for simulations of various aspects of radiation-matter interactions. This presentation will discuss several recent and on-going developments in Monte Carlo methodology for simulations of diffusion-reaction processes leading to accumulation of damage in materials subjected to prolonged particle irradiation. The methods to be discussed include: (1) a novel stochastic variant of the mean-field Rate Theory termed Stochastic Cluster Dynamics that circumvents combinatorial explosion in the number of rate equations required to handle complex material systems, (2) a novel algorithm of First Passage Kinetic Monte Carlo that is both efficient and exact for a wide range of diffusion-reaction models, and (3) exact first-passage acceleration of lattice Monte Carlo simulations in the context of ABV-type models for diffusive processes in binary and multi-component alloys. The focus will be mostly on algorithmic and computational aspects of the above methods.