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Lattice QED with dual variables

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With the help of auxiliary fields, it is possible to integrate out analytically the link variables in lattice gauge theory with staggered fermions, for arbitrary values of the lattice coupling. In the case of $N_f=1$ QED, the subsequent Grassmann integration yields a dual representation of the partition function, which traces over an ensemble of monomers, dimers, and electron loops coupled to the auxiliary fields. We simulate this system using diagrammatic Monte Carlo methods, and explore the residual sign problem which survives after all the analytical integrations.

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