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Tackling the Numerical Sign Problem: Complex Langevin Method Applied to the 2-D Repulsive Hubbard Model[1] MITCHELL YOUNG, Undergraduate Researcher at UNC Chapel Hill — One of the major unsolved dilemmas in physics today is the numerical sign problem. The sign problem involves the difficulty in numerically evaluating integrals of highly oscillatory multi-dimensional functions, plaguing many fields of physics from lattice QCD to condensed matter physics. For many particle systems, this generally occurs in the calculation of functional integrals without a positive definite measure. In this case, standard methods such as Monte Carlo Integration cannot be applied since the measure can no longer be interpreted as a probability distribution. One of the most promising approaches for tackling this sign problem is the Complex Langevin Method, which involves drawing the entire problem into the complex plane and evolving the solution according to the complex Langevin equation. Here we present the results of applying the Complex Langevin Method to the 2-D repulsive Hubbard model, the archetypal model for studying strongly interacting fermionic systems which exhibits the sign problem in the repulsive case.

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