Abstract Submitted
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Quantum speed-up for turbulent mixing simulation[1] GUANGLEI XU, ANDREW DALEY, Department of Physics and SUPA, University of Strathclyde, PEYMAN GIVI, Swanson School of Engineering, University of Pittsburgh, ROLANDO SOMMA, Theoretical Division, Los Alamos National Laboratory — Quantum computing techniques have the potential in the future to generate revolutionary advances in many types of computation. The necessary hardware is under rapid development, making it an opportune time to identify possible specific applications across a range of fields, and properly identify the potential of this new paradigm of computing. Turbulent mixing simulation is important in a variety of fields, and is typically accomplished by Monte Carlo methods. To reach high precision in estimating parameters often requires vast computational resources. We have developed a quantum algorithm for turbulent mixing simulation that provides a quadratic speed-up over Monte Carlo methods in terms of number of repetitions needed to achieve designated accuracy. Taking the example of binary scalar mixing process described by a coaslescence/dispersion model, we demonstrate the advantages of our quantum algorithm by illustrating comparisons of statistical error scaling to repetition number between Monte Carlo method and quantum algorithm. This is an important starting point to further understand how quantum algorithms can be directly applied in fluid dynamics, and to estimate the timescales on which quantum hardware will have useful applications in this area of science.

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Guanglei Xu
Department of Physics and SUPA, University of Strathclyde

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