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Quantum simulation of Unruh radiation in a curved spacetime LEI FENG, ZHENDONG ZHANG, KAI-XUAN YAO, University of Chicago, JIAZHONG HU, Tsinghua University, CHENG CHIN, University of Chicago, CHINLAB TEAM — We demonstrate a new approach to simulate quantum many-body systems in a non-inertial frame by parametric modulation of interactions; based on the equivalence principle, the system is effectively in a curved spacetime. Starting with a Bose-Einstein condensate, we periodically modulate the atomic interactions near a Feshbach resonance. An outgoing, fluctuating matterwave field is observed, which faithfully simulates the thermal radiation of vacuum in a highly accelerating frame, predicted by W. Unruh in 1976. Despite the thermal behavior from statistical analysis, we further observe the long-range phase coherence and the temporal reversal of matterwave emission, confirming the quantum origin of the simulated Unruh radiation. Our demonstration offers a new avenue to investigate novel dynamics of quantum systems in a curved spacetime.

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