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Probing the holographic principle using dynamical gauge effects from open spin-orbit coupling[1] JIANSHI ZHAO, CRAIG PRICE, QI LIU, NATHAN GEMELKE, Penn State University — Dynamical gauge fields result from locally defined symmetries and an effective over-labeling of quantum states. Coupling atoms weakly to a reservoir of laser modes can create an effective dynamical gauge field purely due to the disregard of information in the optical states. Here we report measurements revealing effects of open spin-orbit coupling in a system where an effective model can be formed from a non-abelian $SU(2) \times U(1)$ field theory following the Yang-Mills construct. Forming a close analogy to dynamical gauge effects in quantum chromodynamics, we extract a measure of atomic motion which reveals the analog of a closing mass gap for the relevant gauge boson, shedding insight on long standing open problems in gauge-fixing scale anomalies. Using arguments following the holographic principle, we measure scaling relations which can be understood by quantifying information present in the local potential. New prospects using these techniques for developing fractionalization of multi-particle and macroscopic systems using dissipative and non-abelian gauge fields will also be discussed.

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