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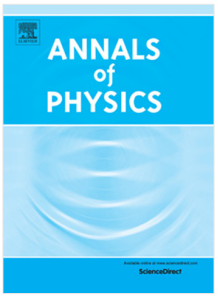

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Can a quantum critical state represent a blackbody?

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Abstract

The blackbody theory of Planck played a seminal role in the development of quantum theory at the turn of the past century. A blackbody cavity is generally thought to be a collection of photons in thermal equilibrium; the radiation emitted is at all wavelengths, and the intensity follows a scaling law, which is Planck's characteristic distribution law. These photons arise from non-interacting normal modes. Here we suggest that certain quantum critical states when heated emit "radiation" at all wavelengths and satisfy all the criteria of a blackbody. An important difference is that the "radiation" does not necessarily consist of non-interacting photons, but also emergent relativistic bosons or fermions. The examples we provide include emergent relativistic fermions at a topological quantum critical point. This perspective on a quantum critical state may be illuminating in many unforeseen ways.