Thermality from a Rindler quench in relativistic spacetime and in the laboratory

Jorma Louko

School of Mathematical Sciences, University of Nottingham, UK

Abstract

Ultracold fermionic atoms in an optical lattice, with a sudden position-dependent change (a quench) in the effective dispersion relation, have been proposed by Rodríguez-Laguna et al (2017) to provide an analogue spacetime test of the Unruh effect. We provide support for this analogue, by studying the energetic and thermal properties of quantum field theory on a corresponding continuum quench spacetime. We in particular clarify how the Unruh effect can prevail despite the energy injected into the field by the quench, and despite the absence of a horizon. These results strengthen the motivation to realise the experimental proposal. We further describe a laboratory implementation (with Biermann, Erne, Gooding, Unruh and Weinfurtner) of the underlying classical dispersion relation change with liquid surface waves.