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Classical Unruh effect in plasma based accelerators

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We show that the classical equivalent to Unruh radiation can be produced by a classical field configuration. This configuration contains two necessary ingredients: a constant electric field and broadband radiation. First, the constant field replicates the gravitational field. Second, the transverse field of the broadband radiation provides the particle oscillations leading to the emission of secondary radiation. In the frame of the accelerated particle, this secondary radiation takes the form of black-body radiation associated with a temperature that is proportional to the particle acceleration. This allows us to define the Unruh-Hawking temperature in a purely classical and non-gravitational context. Furthermore, we show that snowplow acceleration, a well-known process of laser acceleration, can provide simultaneously acceleration and secondary radiation, thus providing an alternative method to produce classical Unruh radiation. Finally, we demonstrate that the radiation emitted by relativistic plasma wakefield can represent a classical analogue of the black-body radiation spectrum seen by an accelerated observer. Its radiation spectrum has a Unruh-Hawking temperature that is controlled by the observer acceleration. This radiation could be experimentally detected in the laboratory today, using tailored plasma density profiles.