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Accelerating Plasma Mirror to Investigate Black Hole Information Loss Paradox

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Plasma wakefields induced by an intense laser pulse or a particle beam can serve as a relativistic plasma mirror, which, as has been pointed out, can serve to focus light to extremely high intensity. Here we propose a different application of such mirrors. Earlier, Chen and Tajima (1999) invoked the violent acceleration of a single electron by an ultra intense laser as a means to investigate the Unruh effect, whereby the black hole Hawking evaporation may be elucidated in the laboratory. Accelerating mirror has long been a toy model in the investigation of quantum field theory in curved space. It has been shown that, in analogy to the Hawking effect in a bona fide curved space, particles can be created from the vacuum of a flat spacetime with an imbedded accelerating mirror. One critical issue associated with the black hole Hawking evaporation is the information loss paradox, which reveals the conflict between general relativity and quantum field theory. The resolution of this paradox is therefore of fundamental importance to physics. We point out that certain signatures emitted from an accelerating plasma mirror may help to resolve this paradox.

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