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Extreme Light Induced Accelerating Plasma Mirrors to Investigate Black Hole Information Loss Paradox

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The question of whether Hawking evaporation violates unitarity, and therefore results in the loss of information, remains unresolved since Hawking's seminal discovery. So far the investigations remain mostly theoretical since it is almost impossible to settle this paradox through direct astrophysical black hole observations. Here we point out that relativistic plasma mirrors induced by state-of-the-art or soon-to-be ultrafast lasers can be accelerated drastically and stopped abruptly by impinging intense x-ray pulses on solid plasma targets with a density gradient. This is analogous to the late time evolution of black hole Hawking evaporation. A conception of such an experiment is proposed and a self-consistent set of physical parameters is presented. Critical issues such as how the black hole unitarity may be preserved can be addressed through the entanglement between the analog Hawking radiation photons and their partner modes.

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