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Can spacetime fluctuations generate entanglement between co-moving accelerated detectors?

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Recent studies [Class. Quant. Grav. 42, 03LT01 (2025); Phys. Rev. D 111, 045023 (2025)] indicate that in a nested sequence of Rindler wedges, vacuum of former Rindler frame appears to be thermally populated for an observer in shifted Rindler frame. Interestingly, this thermality is independent of shift parameter as long as it is non-zero and therefore arises even if the shift parameter is as small as Planck length. Building on this insight, we propose a set-up involving two atoms accelerating with identical acceleration. We find that if their Rindler frames (consequently their trajectories) get infinitesimally separated, the atoms become entangled. Remarkably again, this entanglement, like the perceived thermality, is independent of the shift parameter, provided it is non-vanishing. We investigate the dependence of entanglement on acceleration of the detectors. The present study indicates that the entanglement between two detectors, moving on the same Rindler wedge, is possible. Moreover, small spacetime fluctuations can lead to entanglement between detectors, moving along same classical trajectory. Hence we feel that such theoretical prediction has potential to probe the Planck length nature of spacetime. arXiv: 2504.12674

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