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Gravitational deflection of X-ray superradiance

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The accuracy of clocks has continuously improved up to 10^{-19}, nowadays [1,2], allowing to probe time-dilation in gravitational fields up to millimeter scale vertically at earth surface. We are investigating the effect of inhomogeneous evolution of the background time on spatially coherent quantum objects. In our study we consider a timed Dicke state excitation of nuclear isomer transitions of atoms in a crystal [3]. We find that photons from superradiant reemission of the Dicke state excitation are deflected by gravity. A similar effect by replacing the gravitational acceleration with a centrifugal acceleration can enhance the deflection of the photons. To the end we discuss feasibility questions.

[1] G. E. Marti et. al., Phys. Rev. Lett. 120, 103201 (2018).
[2] S. L. Campbell et. al., Science 358, 90 (2017).
[3] W.-T. Liao, S. Ahrens, Nature Photonics 9, 169 (2015).

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