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Indirect detection of gravitons through quantum entanglement

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We propose an experiment that the entanglement between two macroscopic mirrors suspended at the end of an equal-arm interferometer is destroyed by the noise of gravitons through bremsstrahlung. By calculating the correlation function of the noise, we obtain the decoherence time from the decoherence functional. We estimate that the decoherence time induced by the noise of gravitons in squeezed states stemming from inflation is approximately 20 seconds for 40 km long arms and 40 kg mirrors. Our analysis shows that observation of the decoherence time of quantum entanglement has the potential to detect gravitons indirectly. This indirect detection of gravitons would give strong evidence of quantum gravity.

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