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Title: Interaction-Free Energy Transfer

Abstract: A gedanken experiment generalizing the Elitzur-Vaidman bomb-tester is discussed, in which energy is transferred from a photon to a small low-temperature reservoir, without the photon ever going near it. The photon passes through a Mach-Zender interferometer with the reservoir initially in its motional ground state, which partly overlaps one arm, and always absorbs the photon if they meet. Detecting the photon at the dark port of the interferometer collapses the reservoir into the beam path, increasing its energy, but the photon could not have taken that path or it would have been absorbed. This paradoxical effect only obtains under a specific post-selection, and thus the choice of measurement settings is crucial, and reveals a strongly contextual effect in the experiment, which also has close connection to the Hardy paradox and the 3-box paradox. The weak values of the reservoir-photon system are also examined, revealing anomalous values, and an interesting narrative in which the reservoir gains energy by emitting a pair of virtual photons with negative energy.