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Enhancement of Blackbody Friction due to the Finite Lifetime of Atomic Levels

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The thermal friction force acting on an atom moving relative to a thermal photon bath is known to be proportional to an integral over the imaginary part of the frequency-dependent atomic (dipole) polarizability. Using a numerical approach, we find that blackbody friction on atoms either in dilute environments or in hot ovens is larger than previously thought by orders of magnitude. This enhancement is due to far off-resonant driving of transitions by low-frequency thermal radiation. At typical temperatures, the blackbody radiation maximum lies far below the atomic transition wavelengths. Surprisingly, due to the finite lifetime of atomic levels, which gives rise to Lorentzian line profiles, far off-resonant excitation leads to the dominant contribution to the blackbody friction.

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