Abstract Submitted
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Quantum mechanical aspects of the decay of mechanical vibrations by electromagnetic radiation ALLAN PIERCE[1], Retired — A body undergoing mechanical vibrations loses energy by electromagnetic radiation. If the vibrations are of a thermal nature, and if the body is surrounded by a medium such as air at a lower temperature, then the loss of energy is adequately described by the theory of radiative heat transfer, but mechanical vibrations are generally not associated with thermal equilibrium. The present paper argues that any good approximate account of the physical mechanisms responsible for radiative decay of mechanical vibrations requires some, perhaps modest, understanding of quantum electrodynamics.The analysis begins with the simple example of a molecule in its first excited vibrational state, with the objective of predicting the relaxation time for the decay to the ground state. It is noted that the overall theoretical framework developed by Weisskopf and Wigner (1930) gives the same overall result as the correspondence principle theory advanced somewhat earlier by Slater (1925), and the author consequently seeks to develop a general approximate theory based on the correspondence principle. It is shown in particular that the reciprocal of the relaxation time is a dimensionless quantity times the cube of the fine structure constant times the frequency of the electromagnetic emission.

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