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Photon Mass, Graviton Mass: Zero or Not? ALFRED SCHARFF GOLDHABER, Stony Brook, MICHAEL MARTIN NIETO, Los Alamos — Testing for deviations from simple laws is a time-honored part of physics research. In electricity and magnetism the first approach to such testing, from the eighteenth century well into the twentieth, was to look for departures from -2 of the power of distance between two electric charges or two magnetic poles determining the force between them. Absent a particular length scale, this was a natural choice for parameterizing possible deviations from the simple and esthetic inverse square law. With the advent of relativity and quantum mechanics, and the realization that certain phenomena of light can be described in terms of photon particles, it became appealing to ask if these particles might have a non-zero mass, and Proca found the appropriate modification of the Maxwell equations. Despite the particle-motion origin of this idea, the most powerful way to constrain the size of a possible photon mass is by setting a lower bound on the Compton wavelength, by looking at static electric and especially magnetic fields over increasing length scales. For gravity similar statements apply, but graviton mass is theoretically questionable, and observed phenomena imply either additional sources or departures from Einstein's general relativity.

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