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Can there be massive photons? A pedagogical glance at the origin of mass.

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Summary: Among the most startling experiences a student encounters is learning that, unlike electrons and other elementary particles, photons have no mass. Under certain circumstances, however, the light quantum behaves as if it did have a finite mass. Starting from Maxwell's equations, we discuss how this arises when light interacts with a charged plasma, or travels along a waveguide. The motion of such photons is analyzed using kinematic concepts of special relativity, and we show how a cutoff frequency for effective propagation appears. Seeing how an environment may yield an apparent dynamic mass to the photon paves the way for later understanding: might the Higgs boson field provide other particles, such as the electron, with a mass? This paper is addressed to mid-level physics students, teachers and lecturers, requiring only a knowledge of classical electromagnetic and special relativity theories.

Classification: M50

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