

massless or massive photon?

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The usual argument for massless photons uses the Hamiltonian

$$H = (\sqrt{m^2c^4 + p^2c^2}) \quad (1)$$

and set ($m = 0$) to yield

$$H = pc$$

However, the original Hamiltonian (1) was derived using the Legendre transformation

$$H = pv - L = (\sqrt{m^2c^4 + p^2c^2})$$

If alternatively we start assuming ($v = c$) in the transformation, the result is

$$H = pc - L = pc \quad (2)$$

where no assumption was taken about the mass.

Is this Hamiltonian (2) representing some kind of massive photon (somewhat as in Proca theory [#]) or is really the same that (1)?

[#] http://en.wikipedia.org/wiki/Proca_action

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