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What is a particle?

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If a high school student asks ten physicists what a particle is, he/she might get ten different answers, including a) particle is what we see in the detector, b) a point-like object with mass and various charges, c) a collapsed wave function, d) an excitation of a quantum field or even e) an irreducible representation of the Poincare group. I will briefly discuss strong and weak points of the above definitions and argue for option d) as a promising path to satisfy curiosity of motivated high school students. To introduce particles as excitations or waves in quantum fields at this level is certainly challenging but I believe it is time we tried. I assume that the students are somewhat familiar with a classical harmonic oscillator and classical travelling and standing waves. Using electromagnetic field as an example, I will show how we might picture a single photon as a wave of the minimum amplitude and energy allowed by quantum mechanics - the quantum of electromagnetic field.

Alternate track

I read the instructions above

Yes

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