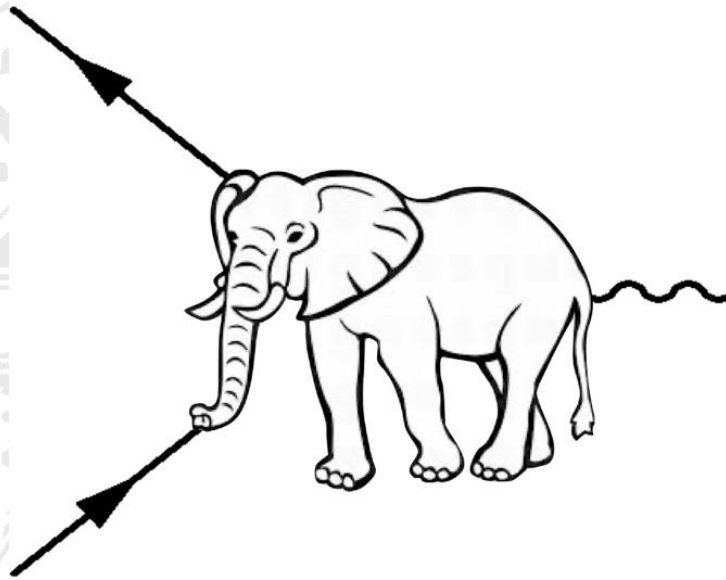




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The Virtues of Virtual Particles

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The Standard Model of particle physics shares several qualities with the nice and accurate prophecies of Agnes Nutter, witch*. Above all, its predictions, as far as they have been tested in experimental settings, have come true to an amazing - even slightly annoying - accuracy. However, while according to Agnes Nutter the world will end next Saturday just before dinner (which is plausible), according to the Standard Model, the world would never have come into existence. The matter we are made of should have (mostly) annihilated with antimatter, shortly after the big bang. This is neither nice nor accurate. Most theories that address the Standard Model's shortcomings predict the existence of heavy new particles. Particle colliders such as the LHC aim to produce these by converting energy to mass, using $E=mc^2$. The collision energy E limits however the mass of the particles that can be produced. Virtual particles are not subject to this constraint. They let us see beyond the energy frontier, where we hope to discover a nicer, more accurate, and more complete description of the fundamental constituents of matter and how they interact.

*) Reported in: Nail Gaiman + Terry Pratchett, Good Omens, ISBN 978-1472258298, 978-0552176453, <https://www.amazon.co.uk/Good-Omens-Season-1/dp/B07FMKMHDF>