MP 14: Mass and Momentum

Time: Thursday 15:45–16:25 Location: HL 102

MP 14.1 Thu 15:45 HL 102

Interpretation of the rest mass of a particle as the rotational energy of its spin — •Matthias Kölbel — Berlin

The rest mass of an elementary particle is usually explained by an interaction with the Higgs field. However, an alternative interpretation of the rest mass can be derived.

In classical mechanics, an angular momentum L is associated with a rotational energy $E_{rot} = \frac{1}{2} * L * \omega$. Therefore one should expect that elementary particles carrying an internal angular momentum (spin) of $L = h/2\pi$ (bosons) or $L = h/4\pi$ (fermions) possess a rotational energy, which depends on the rotational velocity ω of the particle. According to de Broglie, a particle has got a characteristic oscillation time $\tau = h/E$, depending on its relativistic energy $E = mc^2 = \sqrt{(p*c)^2 + (m_0c^2)^2}$. Assuming the rotational period of the spin being equal to de Broglie's oscillation time, the energy equation of the photon transforms into

$$E = h * f = h * \tau^{-1} = h/2\pi * 2\pi/\tau = L * \omega,$$

which resembles the formula for the classical rotational energy except the prefactor $\frac{1}{2}$.

Applying $E = L * \omega$ to other bosons being at rest, we get

$$E = L * \omega = \frac{h}{2\pi} * \frac{2\pi}{\tau} = \frac{h}{\tau} = \frac{h}{h} * m_0c^2 = m_0c^2.$$

In the case of fermions with $L = h/4\pi$ and $\omega = 4\pi/\tau$ (due to their rotation symmetry of 720°), we get the same result: The rest energy m_0c^2 can be equated with the rotational energy of the spin $L * \omega$.

MP 14.2 Thu 16:05 HL 102

The interpretation of Morse and Lennard-Jones energy profiles — •Grit Kalies[1] and Duong D. Do[2] — [1]HTW University of Applied Sciences, Dresden, Germany — [2]The University of Queensland, Brisbane, Australia

In mechanics, the force is interpreted as dynamics. The second Newtonian law of motion, for instance, is interpreted to mean that the force changes the velocity or momentum. The third Newtonian axiom actio = reactio is interpreted as force = counter force. Based on the idea of force interaction, this is described today by four fundamental forces, which are attempted to be unified in vain. Force fields are assumed that have been quantized in quantum field theories to become carrier particles of the force. Force is considered the most important variable in physics [1]. In thermodynamics, a process in interpreted as dynamics. According to the first law of thermodynamics (energy conservation), only a process can change a state variable of a system, and any process takes time, whereby usually several state variables change simultaneously. To resolve the contradiction in the understanding of dynamics, we proposed a change in mechanics and quantum mechanics and introduced the momentum work and the momentum energy [2]. The current interpretation of energy profiles, such as the Morse and Lennard-Jones potentials, is replaced by a process-based interpretation that reveals the forms of energy released during the spontaneous formation of a bond. [1] M. Jammer: Concepts of Force, Harper Torchbook, New York, 1962; [2] G. Kalies, D. D. Do, AIP Adv. 13 (2023), 065121, 055317, 095322, 095126.