Thoughts on a New Definition of Momentum That Makes Physics Simpler and More Consistent

Espen Gaarder Haug
Norwegian University of Life Sciences

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Abstract

We suggest that momentum should be redefined in order to help make physics more consistent and more logical. In this paper, we will propose that there is a rest-mass momentum, a kinetic momentum, and a total momentum.

Key words: momentum, kinetic momentum, rest-mass momentum.

1 Introduction

Today there is no rest-mass momentum in modern physics, which leads to unnecessary complexity and even inconsistency in the field. In modern physics, the momentum for a particle with mass is given by [1]

$$p = \frac{mv}{\sqrt{1-\frac{v^2}{c^2}}} \tag{1}$$

and when $v << c$, we can use the first term of a Taylor series expansion and approximate the momentum very well with $p \approx mv$.

The relativistic energy momentum relation is very important in modern physics

$$E^2 = p^2c^2 + (mc^2)^2 \tag{2}$$

here, to find the momentum of a photon, we can set the mass to zero in the last part of the equation above, solve with respect to momentum, and we will get

$$p = \frac{E}{c} = \frac{\hbar}{\lambda} \tag{3}$$

Relativistic momentum is given by equation 1. In modern physics, photons are always treated as something special. They are special, but do we truly need one set of momentum equations for particles with mass and one set for photons? Based on recent analysis, we will show that this is not necessary.

For photons, the standard relativistic momentum formulas do not work, so here we have defined momentum as $p = \frac{\hbar}{\lambda}$. (In a later version of this paper, we will discuss how this leads to inconsistency in modern physics.)

2 New Momentum Definition

We suggest that the total momentum is given by

$$p_t = \frac{mc}{\sqrt{1-\frac{v^2}{c^2}}} \tag{4}$$

and that the rest-mass momentum is given by $p = mc$. Then a moving particle with mass has a kinetic momentum of

$$p_k = \frac{mc}{\sqrt{1-\frac{v^2}{c^2}}} - mc \tag{5}$$

and when $v << c$, this can be very well approximated by the first term of a Taylor series expansion

$$p_k \approx \frac{1}{2}\frac{mv^2}{c} \tag{6}$$

In our new momentum equation, energy is always equal to momentum times the speed of light. The relationship $E = pc$ is often used in physics, but with the old version of momentum it actually only holds for photons and not for particles like electrons. And the relativistic momentum for particles with mass do not hold for photons, one are operating with two different frameworks that are merged in a bit of a ad-hock way.

Our new momentum defenition leads to a new relativistic energy momentum relation of

$$E = p_k c + mc^2 \tag{7}$$

That is, we have

$$E = \left(\frac{mc}{\sqrt{1-\frac{v^2}{c^2}}} - mc \right) c + mc^2 \tag{8}$$

We claim that this will also hold for photons. The key is to combine it with Haug's maximum velocity [2–5] of matter $v_{max} = c\sqrt{1-\frac{l_p^2}{\bar{\lambda}^2}}$. As discussed in previous papers, in the special case of the Planck mass particle, the maximum velocity is zero

$$v_{max} = c\sqrt{1-\frac{l_p^2}{l_p^2}} = 0 \tag{9}$$

This sounds absurd, but in our view this represents the collision point between two photons. This means for light there is only rest-mass momentum of the form $p = mc$, and the relativistic momentum formula (and all other relativistic formulas) now hold for both light and traditional matter. Modern physics often operates with two sets of rules, as a full connection made between light and matter has not been determined.

We also note that the Planck mass is observational time dependent and only is approximately 10^{-51} kg in a one second observational time-window, but indeed has its enormous traditional value of approx $10^{-8}kg$ in a one Planck time observational time window.

This leads to a new quantum probability theory that is much less mysterious than the existing quantum mechanics theory. Further, it produces one set of equations that apply equally to photons and all other matter. This stands in contrast to modern physics, which relies more on a series of mathematical tricks and complexities to compensate for the lack of a fully understood connection between photons and matter.

References

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