How particles acquire their spin: a Higgs-like mechanism

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Abstract

It seems more and more legitimate to think that elementary particles acquire their mass by interacting with the quantum fields of other particles [1,2]. In the same way as "elementary" entities should be massless, i.e. should transform under translations as the trivial representation, one would expect them to be spinless i.e. to transform trivially under rotations. However, a large number of the known particles considered as elementary are not spinless.

The origin of spin is still a debated question in modern physics. It is usually considered as a consequence of the existence of internal degrees of freedom, a somewhat paradoxical property for allegedly elementary particles. In this article we suggest a different interpretation, reminiscent of the Higgs mechanism line of thought: A particle acquire its spin by coupling to a field defined over space-time. The idea is very similar to that put forward by Berry and Robbins [3,4] to explain Pauli spin statistics. However, our proposal stems from a different perspective.

In conclusion, we suggest that spin is not a fundamental property of elementary particles, but the result of their coupling with particles yet to be discovered, and that, if these particles were massive they could be related to the "dark matter" problem.

References

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