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Phenomenology of fundamental spinons

In condensed matter physics, the theory of spin–charge separation dates back to the 1950 paper of Tomonaga, but experimental confirmation came only after almost a half century. Here we consider the possibility of a similar phenomenon —inspired in part by the reality of Higgs bosons, and therefore of at least one Higgs condensate —which would potentially be observable in Run 2 of the LHC. The qualitative phenomenology is simple: These fundamental spinons would carry only angular momentum (as spin 1/2 particles) plus energy and momentum, with no charge of any kind, so they must be detected as e.g. missing transverse momentum. They could be produced in virtual processes, such as the decay of virtual Z bosons, or real processes, such as emission from W bosons, but always involving vector bosons in the presence of a Higgs condensate. Their masses are undetermined by the theory (just as was the mass of the observed Higgs), but the mass of a spinon pair must exceed the mass of a Z boson, since the decay of real Z bosons is completely explained by Standard Model particles. Here we will make no attempt to justify the theory in which these spinons emerge, whose more conventional predictions include supersymmetry and SO(N) grand unification. The important fact in the present context is that the theory does lead to this prediction of new particles, which are in principle observable in the relatively near future.

additional information

Talk or poster

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