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Higgs Balls: Building Non-Thermal Topological Solitons with the Higgs Field

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Global non-topological solitons (Q-balls) exist when the potential of a charged scalar field grows slower than quadratically. At zero temperature, this requires attractive interactions. We first show that finite temperature effects can generate the necessary terms even in the absence of attractive interactions at zero temperature. As a result, non-topological solitons exist at finite temperature in a variety of models which do not have non-topological solitons at zero temperature.

The necessary finite temperature terms are generated by bosons whose mass depends on the scalar VEV, which makes the Standard Model Higgs sector a natural place to look for them. We show that gauge interactions between Higgs quanta prevent their existence in the Standard Model, but they can exist in extensions of the Standard Model, particularly those with additional scalars.

Author: PEARCE, Lauren (Penn State University-New Kensington)

Presenter: PEARCE, Lauren (Penn State University-New Kensington)

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