Contribution ID: **314** Type: **Parallel**

Merons as the Relevant Topological Charge Carriers in the 2-d O(3) Model

Tuesday 18 June 2019 16:50 (20 minutes)

The $2-d\ O(3)$ model shares many features with $4-d$ non-Abelian gauge theories, including asymptotic freedom, a nonperturbatively generated mass gap and a nontrivial topological charge Q. By an analytic rewriting of the partition function, we identify merons (a particular type of Wolff clusters with $Q = \pm 1/2$) as the relevant topological charge carriers.
In contrast to semiclassical instantons, merons are uniquely identified in the fully nonperturbative functional integral. While instantons are smooth $2-d$ objects, merons are physical objects with a fractal dimension $D = 1.88(1)$, which also exist in the continuum limit. This result follows from the observed scaling of the meron cluster-size distribution. Consistently, the merons of different size exhibit the same fractal dimension. Small merons give rise to a logarithmic divergence of the topological susceptibility which turns out to be entirely physical. In particular, lattice artifact dislocations, which would give rise to power-law divergence, do not seem to contribute in the quantum continuum limit. Furthermore, merons are also responsible for nontrivial theta vacuum effects and explain why the mass gap vanishes at $\theta = \pi$. Our study raises hopes that a solid field theoretical identification of the relevant topological degrees of freedom may also be achievable in non-Abelian gauge theories.

Authors: BIETENHOLZ, Wolfgang (UNAM, Mexico); PINTO BARROS, Joao C. (AEC, Institute for Theoretical Physics, University of Bern); CASPAR, Stephan (AEC, Institute for Theoretical Physics, University of Bern); HORNUNG, Manes (AEC, Institute for Theoretical Physics, University of Bern); WIESE, Uwe-Jens (AEC, Institute for Theoretical Physics, University of Bern)

Presenter: PINTO BARROS, Joao C. (AEC, Institute for Theoretical Physics, University of Bern)

Session Classification: Theoretical Developments

Track Classification: Theoretical Developments