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Callan-Rubakov effect in a chiral gauge theory

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Monopoles are a generic prediction of many UV completion of a U(1) gauge theory and, more importantly, might be part of our physical world.
Surprisingly the scattering of an s-wave massless fermion on a massive monopole is a subtle (and puzzling) problem.
In a vector-like theory, the solution is the Callan-Rubakov effect, which saves unitarity and gauge charge conservation, breaking the anomalous U(1) global symmetries.
In a chiral U(1) gauge theory, the problem is worse, as there are no out-going (multi) particle states in the 2d effective theory that describe the scattering that allows conserving all the gauge charges of an in-going particle, scattering on the monopole, leading to a unitarity puzzle.
In this talk, I analyze a
chiral gauge theory that has a UV completion in terms of an asymptotically free chiral SU(N) gauge theory, allowing us to compute concretely the answer to many questions.
For example, a feature of this model is the existence of a long-range condensate around the monopole that breaks part of the U(1) gauge symmetries, along with some of the global symmetries.
We hope that by studying this concrete example, we can guide others to more systematic approaches (e.g. Boundary CFT ones, where one classifies all the consistent boundary conditions of the 2d CFT), or find loopholes with them.

Primary author: LUZIO, Andrea

Presenter: LUZIO, Andrea

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