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Gravitational waves from metastable cosmic strings

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Cosmic strings, which form during cosmological U(1)-symmetry-breaking phase transitions, represent an intriguing potential source of stochastic gravitational waves from the early Universe. While most studies thus far have focused on stable cosmic strings whose stability is guaranteed by the topology of the underlying vacuum structure, many Grand Unified Theories (GUTs) actually predict the formation of a metastable cosmic-string network that collapses after a finite lifetime in consequence of GUT monopole pair production. In this talk, I will discuss the theoretical description of such a network and its individual components as well as the resulting consequences for the emitted spectrum of primordial gravitational waves. Remarkably, the gravitational-wave signal from metastable cosmic strings may well explain the common-spectrum process recently observed in the 12.5-year NANOGrav pulsar timing data, while at the same time, and in contrast to stable cosmic strings, predicting a signal at higher frequencies still within the reach of current-generation ground-based interferometers. On their way to design sensitivity, existing gravitational-wave experiments will therefore have a realistic chance to probe particle physics processes at energies close to the GUT scale via the observation of gravitational waves from metastable cosmic strings.

Primary author: SCHMITZ, Kai (CERN)

Presenter: SCHMITZ, Kai (CERN)

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