



Alberto Nicolis

Columbia University

The power of (broken) symmetries:
from particle physics to the cosmos

Tuesday,
Nov. 21

4:30 pm

GHC 4307

A reception
will follow
after the
lecture

Symmetries arguably provide the most powerful organizing principle of theoretical physics. For particle physics, symmetries are the basis of effective field theory, an extremely successful theoretical framework for describing the dynamics and interactions of particles. Perhaps counterintuitively, some of the most interesting consequences of symmetries arise when these are "broken" by the state of the system in question ("spontaneous symmetry breaking", or SSB). After reviewing basic aspects of effective field theory and SSB, I will show how the same set of ideas can be fruitfully applied outside of particle physics. I will focus on fluids and superfluids, and on their excitations: sound waves, vortices, phonons, and rotons. I will show how the effective field theory language naturally invites new questions about these systems, and provides efficient tools to answer them. Finally, I will show how the dynamics of cosmological perturbations can also be understood in terms of SSB and effective field theory.



A lecture within the MCS Center for Theoretical Sciences