

20193\_phys\_730\_50662: Selected Topics in Particle Physics

Provisional course outline

## SYMMETRY IN PHYSICS

This course is about Symmetry in Physics. It will begin with the formulation of "global" symmetry of the action in the context of classical mechanics, continue with "local" gauge symmetry on the worldline and its generalization to canonical transformations as a local gauge symmetry in phase space, leading to the concepts of 2T-physics. Then global symmetry and local symmetry in field theory, as well as spontaneous symmetry breakdown, will be discussed and will be illustrated in the context of the Standard Model of Particles and Forces as well as in General Relativity. After such illustrative examples, the course will continue with the classification of symmetries and supersymmetries as well as representation theory as used in physics. This will include the classification of Lie algebras and Lie superalgebras, the techniques of tensors, Young tableaux and supertableaux in representation theory, direct products of representations, the decomposition of representations into representations of subgroups, and their applications in various contexts of physical models.

If time permits, additional topics may include: global/local symmetry and supersymmetry in string theory, string field theory, cosmology, nuclear physics, and more.

A list of topics from my 2007 set of Lectures on Symmetry can be found at: <http://physics1.usc.edu/~bars/homepage/LecturesSymmetries2007-contents.pdf> . An updated version will be provided with the outline of the course in August 2019.