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UNIVERSITÀ
DI TRENTO
Dipartimento di
Fisica

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Magnetic topology in space physics

Abstract

The physics of the heliosphere is, on a large range of scales, strongly influenced by the behaviour of the Sun's magnetic field. From the formation of solar flares and coronal mass ejections on scales of metres to megametres, to the modulation of high energy cosmic rays across the entire heliosphere, magnetic fields play a leading role. Many phenomena involve highly complex magnetic fields, both in terms of their geometry and their topology (i.e. how they are connected). Furthermore, the changing of magnetic topology, known as magnetic reconnection, is one of the fundamental ways that magnetic fields can release energy and is the basis of many models of solar eruptions. In this talk, I will give an overview on some recent theoretical work related to magnetic topology. In particular, I will discuss the generalization of the topological invariant called magnetic helicity, and introduce a useful normalized version of this quantity called magnetic winding. I will also discuss recent work on reconnection, both on how to model reconnection in a turbulent plasma and a new local theory that links directly to the forces of the magnetic field. I will combine all of the above with applications and discuss links to recent work with colleagues from Trento.

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