SEMINARIO DE ANÁLISIS MATEMÁTICO Y MATEMÁTICA APLICADA

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Periodic dynamics of a charged particle in electromagnetic fields with singularities

In this talk we shall focus on the Lorentz Force equation (LFE), which models the relativistic dynamics of a charged particle in an electromagnetic field. It has its origin in the pioneering works of Poincaré and Planck and, together with Maxwell's equations, they both compose the backbone of Classical Electrodynamics. Despite being a very classical equation, there has been a remarkable lack of qualitative and quantitative results about its dynamics until recently. One of the main reasons is that the proper mathematical tools for it were developed during the last quarter of the last century. Moreover, such techniques were conceived in an abstract mathematical framework, and their applications to the LFE barely appear during the last decade. Some of these achievements for generic electromagnetic field will be commented during the talk, as the Critical Point Theory due to Arcoya, Torres and Bereanu. On the other hand, it shall be also presented the model of a charged particle in the electromagnetic field generated by an electrically neutral infinite straight wire with a time-periodic oscillating (AC-DC) current. By using global continuation and topological degree, we identify a bi-parametric family of radially periodic motions. The proofs involve some delicate estimations of the induced electromagnetic field (as solution of Maxwell's equations), which can be of independent interest.

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