

Seminario de Geometría y Topología



Completeness of inextensible trajectories of accelerated observers and charged particles in stationary spacetimes

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Resumen:

Abstract.

Let (M, g) be an $n(\geq 2)$ -dimensional spacetime and F an electromagnetic field on M , i.e., a closed 2-form on the spacetime. Let us consider the following second order differential equation,

$$\frac{D\gamma'}{dt} = \frac{q}{m} \tilde{F}(\gamma'), \quad (1)$$

where \tilde{F} the skew-adjoint tensor field defined by F via $F(X, Y) = g(X, \tilde{F}(Y))$, D/dt represents the Levi-Civita covariant derivative along γ , $q \in \mathbb{R}$, $m > 0$ are constants and γ' denotes the velocity of γ .

We know that, given an initial event $p \in M$ and an initial velocity $v \in T_pM$, there exists only one solution of (1) satisfying the conditions

$$\gamma(0) = p, \quad \gamma'(0) = v.$$

When the parameter of γ lives in the whole real line, we will say that γ is a *complete* solution of equation (1). This differential equation is well-known in Relativity and it is called the Lorentz force equation. It governs the dynamics of a relativistic charged particle with mass $m > 0$ and electric charge q , in presence of an electromagnetic field F . Our aim in this talk is to find suitable assumptions on the electromagnetic field and on the spacetime in order to get that any inextensible electromagnetic trajectory is complete (improving the results given in [1]). This fact admits an accurate interpretation: any charged particle in spacetime lives forever.

These results are contained in [2], [3], [4], and partially improve the given ones in [1].

References

- [1] A.M. Candela, A. Romero and M. Sánchez, Completeness of the trajectories of particles coupled to a general force field, *Arch. Rational Mech. Anal.*, **208**, 255–274, (2013).
- [2] D. de la Fuente and A. Romero, Uniformly accelerated motion in General Relativity: completeness of inextensible trajectories, *Gen. Relativ. Gravit.*, **47**:33, (2015).
- [3] D. de la Fuente, A. Romero and P.J. Torres, Unchanged direction motion in General Relativity: the problem of prescribing acceleration, *J. Math. Phys.*, **56**, 112501 (2015).
- [4] D. de la Fuente and A. Romero, Completeness of electromagnetic trajectories in stationary spacetimes. *Submitted*.

Lugar: Universidad Complutense de Madrid

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Fecha y Hora: Martes, 24 de enero de 2017, 12:00

https://www.ucm.es/geometria_topologia/curso-academico-2016-2017-1