

International Seminar on Applied Geometry in Andalusia

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Geometry of submanifolds in Lorentzian geometry with applications

I will give a self-contained review of the geometry inherited by submanifolds of any codimension in Lorentzian manifolds of arbitrary dimension. The differences with the proper Riemannian case will be stressed. In particular, I will devote special attention to "general hypersurfaces", that is, codimension one submanifolds with a possibly changing causal character. The case of codimension two, and the importance of the mean curvature vector and its causal character, will deserve special emphasis too.

I will present many applications from both the physical and the mathematical point of view, highlighting the case of General Relativity and its relatives. Among these applications, I will specifically consider the following:

- generalizations of minimal surfaces, and the concept of trapped submanifold which is of paramount importance in fields such as singularity theorems in GR.
- interplay of the above with (generalized) symmetries.
- geometry of null hypersurfaces.
- the matching of spacetimes and its relevance in different physical situations
- applications to "brane worlds"