Geometric properties of spacelike hypersurfaces in the Lorentz-Minkowski space with the same Riemannian and Lorentzian mean curvature

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Spacelike hypersurfaces in the Lorentz-Minkowski space $\mathbb{L}^{n+1}$ can be endowed with two Riemannian metrics, the one inherited from $\mathbb{L}^{n+1}$ and the one induced by the Euclidean metric of $\mathbb{R}^{n+1}$. As a direct consequence of the classical theorems of Bernstein and Calabi-Bernstein, and of the generalization of the last one to arbitrary dimension, we can deduce that the only entire graphs in $\mathbb{L}^{n+1}$ that are simultaneously minimal and maximal are the spacelike hyperplanes. Using a theorem of Heinz, Chern and Flanders, we can extend this result to entire spacelike graphs with the same constant mean curvature functions H_R and H_L.

We consider the general case of spacelike hypersurfaces with the same Riemannian and Lorentzian mean curvature functions not necessarily constant, and we study some of their geometric properties. Specifically, we prove that a spacelike hypersurface in $\mathbb{L}^{n+1}$ such that $H_R = H_L$ does not have any elliptic points. As an application of this result jointly with a well-known result by Osserman about the non-existence of ellictic points for a certain class of compact hypersurfaces in $\mathbb{R}^{n+1}$, we give some interesting consequences about the geometry of such hypersurfaces.

This is a joint work with Alma L. Albujer and Magdalena Caballero.

References

[1] E. M. Alarcón, A. L. Albujer and M. Caballero, Spacelike hypersurfaces in the Lorentz-Minkowski space with the same Riemannian and Lorentzian mean curvature, submited to the *8th International Meeting on Lorentzian Geometry proceedings* (2017).

[2] E. M. Alarcón, A. L. Albujer and M. Caballero, On the solutions to the $H_R = H_L$ hypersurface equation, submited to the *International Workshop on Theory of Submanifolds proceedings* (2017).