Uniqueness of spacelike hypersurfaces of constant mean curvature in cosmological models with certain symmetries

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In general relativity, symmetry is usually based on the assumption of the existence of a one-parameter group of transformations generated by a Killing or, more generally, conformal vector field. Although it is not always assumed the same causal character for the infinitesimal symmetry, the timelike choice is natural, since the integral curves of such a timelike infinitesimal symmetry provide a privileged class of observers in the spacetime. The presence of such a vector field is not enough to prevent the existence of closed causal curves. However, if the timelike conformal vector field is globally the gradient of some smooth function, then the (clearly noncompact) spacetime admits a global time function. Therefore, it is stably causal. Finally, spacetimes with a timelike gradient conformal vector field (GCS spacetimes) have another interesting property, they admit a foliation by constant mean curvature (CMC) spacelike hypersurfaces.

The aim of this talk is to introduce a new technique to study CMC spacelike hypersurfaces in GCS spacetimes and to give new uniqueness results for compact CMC spacelike hypersurfaces in these ambient spacetimes, both in the parametric and nonparametric case. As an application, the leaves of the natural spacelike foliation of such spacetimes are characterized in some relevant cases.

This talk is based on a joint work with Alfonso Romero and Rafael M. Rubio.

I prefer a communication.

References

[1] M. Caballero, A. Romero and R. M. Rubio, Constant mean curvature spacelike hypersurfaces in Lorentzian manifolds with a timelike gradient conformal vector field, *Classical and Quantum Gravity* (2011), to appear.