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Amores, A. M. **[Amores Lázaro, Ángel Miguel]** (E-MADCM-GT);
Gutiérrez, M. **[Gutiérrez, Manuel]** (E-MALS-GT)

The b-completion of the Friedmann space. (English summary)

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It is well known that in spite of its mathematical elegance the b-completion is unsatisfactory in some respects. In particular, the closed Friedmann space has a past singularity whose only neighborhood is the entire space-time.

This paper studies the general class of Friedmann space-times, open and closed, and extends the known results as follows: The closed Friedmann space has exactly one singularity, and its only neighbourhood is the entire space-time. The non-closed Friedmann models have a unique past essential singularity, and its only neighbourhood is the entire space-time. In the non-closed Friedmann models, causal future maximal geodesics are not b-incomplete, and so there is no future singularity in any sense.

The proof proceeds first by establishing general results on null geodesics in warped product metrics, and then making detailed calculations in the various special cases of the Friedmann models.

Reviewed by *Robert J. Low*