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Conformal Singularities

Let (M, g) be a space-time. Suppose there exists a manifold $\tilde{M}$ with boundary $\partial\tilde{M}$ such that

1. $\tilde{M} = M \cup \partial\tilde{M}$ and for each $X \in \partial\tilde{M}$ there exists a triple $(\tilde{U}, \tilde{g}, \Omega)$, with $\tilde{U}$ an open neighborhood of X in $\tilde{M}, \tilde{g}$ a Lorentzian metric on $\tilde{U}$, and Ω aC^∞ a real valued function on $\tilde{U}$ such that
2. $\tilde{U} - \partial\tilde{U} \cap M$ and $\partial\tilde{U} = \tilde{U} \cap \partial\tilde{M}$:
3. $g = \Omega^2\tilde{g}$ on $\tilde{U} - \partial\tilde{U}$; $\Omega|\partial\tilde{U} = 0, \Omega|(\tilde{U} - \partial\tilde{U}) > 0$ and $\nabla\Omega$ is no nowhere zero on $\tilde{U}$.

Then $\partial\tilde{M}$ is a conformal sigularity of (M, g). This definition due to Richard P. A. A. Newmann [2] is used to show that Friedmann singularity [1] is physical conformal singularity.

It is proved also that if γ is an incomplete null geodesic terminating at conformal singularity of strongly causal space-time, then γ can be reparameterized, in a neighborhood of the conformal singularity, by an affine parameter to give a complete null geodesic.

References [1] Belinski, V. A., Khalatnikov, I. M., and Lifschitz, E. M. (1982). "A General Solutions of the Einstein Equations with a Time Singularity", Adv. Phys. 31, pp. 639 - 667. [2] Newmann, R. P. A. C. (1993). "On the Structure of Conformal Singularities in Classical General Relativity", Proc. R. Soc. Lond. A 443, pp. 473 - 492.