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Cosmic Acceleration Induced by Friedmann-Static Shock Waves

In 1970, Taub sought to construct a particular two-parameter family of spherically symmetric self-similar shock-wave solutions to the Einstein field equations with a perfect fluid source. This family would consist of a Friedmann-like interior spacetime expanding into a static exterior spacetime, the physical realisation of which would be a general relativistic explosion. Taub was not successful, but in 2002 Smoller and Temple were able to construct an interior family of Friedmann-like spacetimes local to the centre of expansion. These Friedmann-like spacetimes had the interesting property of inducing an accelerated expansion despite solving the Einstein field equations in the absence of a cosmological constant. This observation led Smoller and Temple to conjecture that a vast primordial shock wave, consisting of a Friedmann-like spacetime on the interior, could account for the cosmic acceleration observed today without the need for dark energy. In this talk I will demonstrate how to construct this family of Friedmann-Static shock waves numerically and then outline the details of a formal existence proof. Furthermore, the predicted rate of expansion induced by these shock waves and their viability as cosmological models will be discussed.

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