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Ultraviolet Divergences in Cosmological Correlations

A method is developed for dealing with ultraviolet divergences in calculations of cosmological correlations, which does not depend on dimensional regularization. An extended version of the WKB approximation is used to analyze the divergences in these calculations, and these divergences are controlled by the introduction of Pauli--Villars regulator fields. This approach is illustrated in the theory of a scalar field with arbitrary self-interactions in a fixed flat-space Robertson--Walker metric with arbitrary scale factor $a(t)$. Explicit formulas are given for the counterterms needed to cancel all dependence on the regulator properties, and an explicit prescription is given for calculating finite regulator-independent correlation functions. The possibility of infrared divergences in this theory is briefly considered.

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