Renormalization of quantum field theory in curved space-time.
Brief lecture course for beginners

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The course is a brief pedagogical introduction to renormalization of quantum field theory in an external gravitational field. Course consists of the following three lectures:

Lecture 1. Reminder of the basic field models in flat space, path integrals and Feynman diagrams. Effective action. Loop expansion. Divergences of Feynman diagrams. Dimensional regularization. Notion of counterterms. Superficial degree of divergences. Renormalizable and non-renormalizable theories. Arbitrariness of renormalalization procedure and normalization conditions.

Lecture 2. Field models in curved space-time, non-minimal coupling to gravity. Superficial degree of divergences in gravitational field. Renormalization of vacuum energy, renormalization of non-minimal coupling.

Lecture 3. Renormalization group equation for field theory in external gravitational field. Running coupling constants for parameters of non-minimal coupling. Application of the renormalization group for calculating the effective action.

The course assumes preliminary familiarity with the basic notions of quantum field theory, including path integrals and Feynman diagrams.