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Optimization and Stabilization of Functional Renormalization Group Flows

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We revisit optimization of functional renormalization group flows by analyzing regularized loop integrals. This leads us to a principle, the Principle of Strongest Singularity, and a corresponding order relation which allows to order existing regularization schemes with respect to the stability of renormalization group flows. Moreover, the order relation can be used to construct new regulators in a systematic fashion. For studies of critical behavior, which require to follow renormalization group flows down to the deep infrared regime, such new regulators may turn out to be particularly useful. The general application of this principle is demonstrated with the aid of a scalar field theory which is solved over a wide range of scales with novel methods borrowed from numerical fluid dynamics.

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