Abstract

Effective self-consistent solutions from Asymptotically Safe Gravity

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The Wilsonian Renormalization Group (RG) provides key concepts and tool to tackle crucial questions in both condensed matter physics and quantum field theory. Its fundamentally non-perturbative character permits to explore the RG flow through the entire space of theories, and study its evolution from the infrared regime to ultra-high energies.

One of the most compelling consequences of the Wilsonian idea of renormalization is the possibility of constructing a well-defined quantum theory for the gravitational interaction within the standard and well-tested framework of quantum field theory. The concept of asymptotic safety for quantum gravity, first conjectured by Weinberg, is strictly related to the existence of a non-trivial fixed point of the gravitational RG flow. Such a fixed point would in fact guarantee the non-perturbative renormalizability of gravity.

In the framework of Asymptotic Safety, an essential problem is to understand how the effective action of quantum gravity, encompassing all quantum fluctuations, looks like and what are the solutions to the corresponding quantum equations of motion. Due to the anti-screening behavior of the Newton's coupling at high energies, substantial modifications to the spacetime-dynamics are expected to occur in strong-curvature regimes. In this talk I will show how these modified solutions can be constructed self-consistently within semi-classical approaches. The question of finding an effective action which reproduces these semi-classical solutions and its interpretation will also be discussed in detail.