From Infinities in QED to the General Renormalization Group

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At its birth, Quantum Field Theory (QFT) has been confronted with a somewhat unexpected problem, the appearance of infinities. The calculation of physical processes was yielding infinite results. An empirical recipe, called renormalization, was eventually discovered, which allowed deriving finite predictions from divergent expressions. The procedure would hardly have been convincing if the corresponding predictions would not have been confirmed with increasing precision by experiments. A new concept, Renormalization Group, first abstracted from formal properties of QFT, but whose full meaning, in a more general form, was only completely appreciated in the general framework of continuous, macroscopic phase transitions, has led, later, to a satisfactory interpretation of renormalizable QFT and to the application of QFT methods to the calculation of universal quantities in critical phenomena [1].

[1] J. Zinn-Justin, *Quantum Field Theory and Critical Phenomena*, Fourth Edition, Oxford University Press (2002)

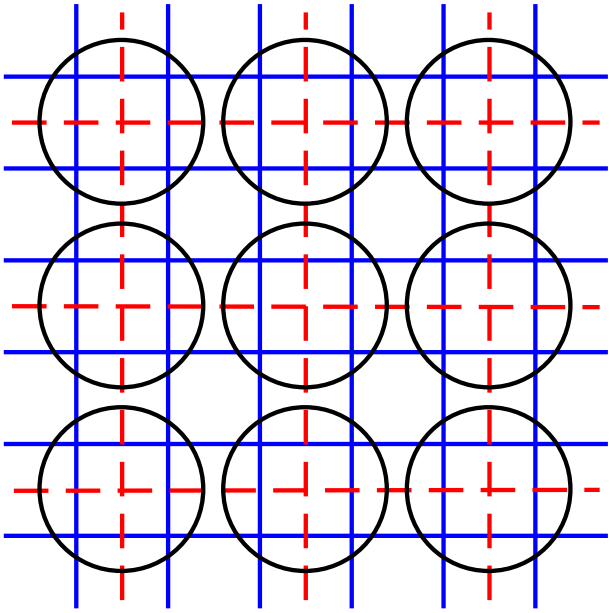

Figure 1: Illustration of the Kadanoff decimation scheme which represents an important step of the renormalization group approach.