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Title: Heat Kernel Methods in Simple Renormalizable Systems.

Abstract: In this talk, we will give three examples of singular interactions which require renormalization to have well-defined Hamiltonians. These are attractive delta function potentials in two dimensions, nonrelativistic Lee model in three dimensions and nonrelativistic many body version of the attractive contact interaction, the lambda-phi-four model. Renormalization is needed to cure the divergences coming from the short distance behaviour. Therefore, it is expected that these singular interactions on manifolds should also be cured by similar methods. Indeed this is the case, the most natural tool is the heat kernel, to be implemented by a method developed by Rajeev in the flat case. We will obtain various results by using short time as well as some global long time estimates on heat kernels. For example, we can prove that the ground state energy in the Lee model is bounded from below for any number of particles.