Title:	Semiclassical Methods
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Abstract:	An interesting question that can be asked of a quantum system is whether it can produce a classical effect. We can loosely phrase this as asking whether quantum evolution can produce a “tennis ball”. To study this question, we need to explore transition probabilities between an initial state and a final state which is chosen to model the classical effect. In text book quantum mechanics, examples of such classical states are the “coherent states”. These have the property that the associated probability is tightly peaked on the cor responding classical trajectory in position space. A classical particle has energies and momenta that are expressed in Joules. In particular, since the quantum energies are usually proportional to ¯h, this implies the coherent states we are interested in have high occupation numbers N □ 1¯h. The technical problem we face now is to calculate the transition amplitude be tween an initial state with small occupation numbers to a final state with very large occupation numbers N □ 1¯h . In our work, these transitions are driven by either ex ternal sources, which we model as operator insertions at time t = 0, or by additional interaction terms in the Hamiltonian. Such transitions have been considered in the literature. For instance, the review [3] describes a procedure to calculate the transition amplitude for the process few −→ many particle production having high energy and large number of particles in the final state. The key aspect is the saddle point approximation to the path integral which describes this amplitude. We therefore adapt the methods in that review to a final state having a single particle with high energy. Subsequently, this idea can be extended to quantum field theory. In this case, the final state will be chosen to be a suitable coherent state of the field theory
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