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Quantum and Classical Dynamics of Heavy Quarks in a Quark-Gluon Plasma

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Heavy quarkonium related observables are very useful to obtain information about the medium created in relativistic heavy ion collisions. In recent years the theoretical description of quarkonium in a medium has moved towards a more dynamical picture in which decay and recombination processes are very important. In this talk we will discuss the equations that describe the evolution of the heavy quarks reduced density matrix in different approximations, highlighting the color dynamics that is absent in the Abelian case, and we will study their semi-classical limit. This will allow us to obtain stochastic equations (similar to Langevin or Boltzmann equations) that can be useful to obtain phenomenological predictions. We will observe that the region of validity of the Langevin-like or Boltzmann-like equations in QCD is much smaller than in the corresponding QED case. The reason for this can be understood by studying how differently the free energy evolves in these two theories. This observation will allow us to propose an equation with a small computational cost that captures many of the essential features of quarkonium evolution in a QCD plasma.

These results are based on [1] and on work in preparation.

[1]-Quantum and Classical Dynamics of Heavy Quarks in a Quark-Gluon Plasma. ArXiv:1711.10812. J-P. Blaizot and M. A. Escobedo.

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