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Heavy quarkonium in the quark-gluon plasma as an open quantum system

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The quark-gluon plasma (QGP) is a new state of matter that appears at extremely large temperatures and densities. This phase appeared in the early universe and, nowadays, we can recreate it in the laboratory using ultrarelativistic heavy ion collisions. However, it is very challenging to obtain information about the matter created in these collisions as the medium only exists for a very small time.
Heavy quarkonium is a good probe of the medium. On one hand, the production of heavy quark pairs involves large energies and does not depend on the medium. On the other hand, the formation of bound states is affected by the medium. Therefore, measuring the production of quarkonium states we can deduce the properties of the medium.
In the last decade, we have understood that three mechanism modify the yield of quarkonium in heavy ion collisions: the screening of chromoelectric fields, the medium-induced decay width and recombination. It is challenging to include all these effects in a consistent way, specially when thermal effects are not a perturbation and we cannot use the semi-classical approximation.
A promising approach put forward in the last years is to understand quarkonium as an open quantum system. I will report recent advances in this approach, from the derivation of the Lindblad equation to the phenomenological application. I will show how we can make predictions for a wide range of observables, obtaining results compatible with observations.

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