The nuclear Many-Body problem: an open quantum systems perspective.

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Similarly to other complex systems, the understanding and description of nuclear processes in a simple way often requires the reduction of the information to few, selected degrees of freedom. The irrelevant degrees of freedom then act as an environment for the relevant ones. Using this strategy, nuclear systems enters into the class of Open Quantum Systems (OQS) and many phenomena can be studied, namely dissipation, fluctuations, decoherence...

In this contribution, the connection between nuclear physics and OQS will be illustrated in two special cases (i) the case of fusing nuclei (ii) the microscopic nuclear many-body problem. In the former case, when two nuclei collide with each others many channels are open and can influence the dynamics. The role of rotational states as well as intrinsic degrees of freedom disorder will be discussed. In the case (ii), I will show how mean-field theory can be seen as a starting point to develop new approaches where two- and more body correlations can be seen as an environment. A special attention will be paid to make connection with OQS theory concepts: master and Lindblad equation, non-Markovian effects, quantum jumps and quantum Monte-Carlo...

Refs:


G. Hupin and D. Lacroix, “Quantum Monte Carlo method applied to non-Markovian barrier transmission” Physical Review C81, 014609 (2010).


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