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## **General framework for the characterisation of complex processes with memory**

Traditional descriptions of the dynamics of open quantum systems are plagued by unphysical results as soon as memory effects play a non-negligible role. These effects commonly arise when the system of interest has a complex and structured environment. To overcome these shortcomings, a new unified scheme for operationally describing general quantum dynamics, known as the process tensor formalism, has been developed. This new framework allows -- independent of the details of the system-environment interaction -- for a full characterisation of the underlying dynamics based on a finite number of local manipulations, and enables one to quantify its complexity in a clear-cut manner.

I will outline this formalism in a general context, and demonstrate how it constitutes the natural generalisation of frameworks used for the description of memoryless processes. Furthermore, I will discuss, how this experimentally reconstructible description of quantum dynamics could be used to answer fundamental questions about the ubiquity of Markovian (i.e., memoryless) processes, and pave the way towards an operationally well-defined understanding of memory as a resource.