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# Description of Multipartite Quantum Entanglement with the Help of Nilpotent Variables

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Abstract:

Inseparability of quantum states of composite systems, discovered in the early days of quantum mechanics by A. Einstein, B. Podolsky, and N. Rosen named "entanglement" ("Verschränkung") by E. Schrödinger , became one of the central concepts of contemporary physics during the last decade. Entanglement plays now a vital role within quantum information science, representing both the defining resource for quantum communication - where it enables, in particular, non-classical protocols such as quantum teleportation and it leads to enhanced security in cryptographic tasks - and a key ingredient for determining the efficiency of quantum algorithms and quantum computation schemes. In addition, studies of entanglement have also proved be relevant to fields as different as atomic physics, quantum chaos, quantum phase transitions, and quantum networks. We give an exhaustive description of multipartite entanglement for composite quantum system in pure states, which is based on a well-developed mathematical concept of nilpotent variables that are not so often used in phys ics. Nevertheless this concept turns to be extremely convenient and general, as long as one considers systems composed of elements each of which contains a finite number of quantum levels.