1090-93-421 **Francesca Albertini** and **Domenico D'Alessandro*** (dmdaless@gmail.com), 440 Carver Hall, Ames, IA 50011, and **Raffaele Romano**. *Exact Lie algebraic conditions for the indirect controllability of quantum mechanical systems.*

In several schemes for the control of quantum systems, a target quantum system S is put in contact with an auxiliary system A and the active control can directly affect only A. Therefore the system S is controlled indirectly through the interaction with A. The quantum system S is said to be indirectly controllable if every unitary transformation can be performed on the state of S with this scheme. The indirect controllability of S depends on the dynamical Lie algebra characterizing the dynamics of the total system S+A and on the initial state of the auxiliary system A. In this talk, we describe this characterization exactly. If the dimension of the system A is greater than or equal to 3, indirect controllability of S is equivalent to complete controllability of the total system S+A, i.e., every unitary transformation on S+A can be obtained. If the dimension of A is equal to 2, the exact condition for indirect controllability is given in terms of a Lie algebra L which describes the evolution on the system S. We prove that indirect controllability is verified if and only if L is the full Lie algebra of skew-Hermitian matrices in appropriate dimensions. and the initial state of the auxiliary system is pure. (Received March 05, 2013)