



## JOINT QUANTOP/LTC SEMINAR

**Title:** Navigation in Hilbert space by quantum state mirrors

**Speaker:** Nikolay V. Vitanov  
Sofia University, Bulgaria

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**Place:** 1520-732

**Abstract:**

We propose a simple physical implementation of the quantum Householder reflection (QHR) in an  $N$ -pod quantum system of  $N$  degenerate states (forming a qunit) coupled simultaneously to an ancillary excited state by  $N$  resonant or nearly resonant pulsed external fields. We use QHR as a building block to construct arbitrary preselected unitary transformations. The most general  $U(N)$  transformation can be factorized (and thereby produced) by at most  $N$  QHRs. As an example, we propose a recipe for constructing the quantum Fourier transform (QFT) by at most  $N-1$  interaction steps. For example, QFT requires a single QHR for  $N=2$ , and only two QHRs for  $N=3$  and  $4$ . We also show that any two pure states can be linked by just a single QHR. The transfer between any two mixed states with the same dynamic invariants requires in general  $N$  QHRs. An arbitrary preselected mixed state can be synthesized by using a combination of QHRs and incoherent processes (pure dephasing or spontaneous emission).

Michael Drewsen