

# Joint CQSE and CASTS Seminar

Weekly Seminar  
Oct. 14, 2011 (Friday)

TIME Oct. 14, 14:30 ~ 15:30  
TITLE Nonequilibrium tunneling in the quantum Duffing model  
SPEAKER Dr. Alec Maassen van den Brink  
Research Center for Applied Sciences, Academia Sinica  
PLACE Rm716, CCMS & New Physics Building, NTU

## Abstract

The Duffing model is an oscillator with weak near-resonant driving, damping, and nonlinearity, which has often been studied in classical mechanics. For certain parameters, the stationary amplitude and phase of this system bifurcate depending on initial conditions, and vary widely from one stable branch to the other.

Due to this sensitivity, the system can be used for constructing detection devices.

In recent years, an implementation using superconducting devices --the so-called Josephson bifurcation amplifier (JBA)--has been successfully used experimentally for superconducting qubit readout.

In the experimental literature, the JBA is often taken as classical.

However, for e.g. understanding how the stability of the stationary states is modified by tunneling, a proper quantum analysis is necessary. Such tunneling transitions would be an error process from the point of view of detector applications.

One thus has to study dissipative tunneling not between two potential wells, but between the limit cycles of a nonlinear dynamical system. Our current best data, supported by semi-analytical asymptotic work, point at some intriguing aspects particular to the nonequilibrium setting, including noncommuting classical and low-temperature limits.

