# Colloquium Notice

## Mikhail Shneider

**Applied Physics Group, Department of Mechanical and Aerospace Engineering**

*Molecular ensembles in non-resonant optical lattices*

In this talk recent theoretical and experimental results on the interaction of optical lattices with neutral gases will be reviewed. Small gas density perturbations produced by the electrostrictive effects of laser beams (when the optical potential well depth << kT) can be used for powerful nonintrusive diagnostics based on coherent Rayleigh and Rayleigh-Brillouin scattering. Effects such as bulk drift can be induced in a gas by a periodic optical traveling wave (lattice), even when the mean kinetic energy is much greater that the maximum optical potential provided by the field. With increasing laser beam intensities, the optical potential can trap a large fraction of the gas. In this case, acceleration or deceleration of the gas is possible. Gas particles cannot be trapped in the highly collisional regime. Analysis of the trapped and untrapped motion of particles demonstrates that atoms and molecules can be accelerated from room temperature to velocities in the 10 to 100 km/s range over distances of 100s of microns. Recently, such experiment was successfully performed by Dr. Peter Barker's group in Great Britain. The effects of coupling of non-resonant laser radiation to a gas will be discussed. In all cases when a lattice induces a periodic modulation of the gas density, strong Bragg diffraction of light can occur. It can potentially limit the achievable intensities inside the optical lattice limiting the ability to manipulate the gas. The self-consistent evolution of the input laser beams via the light-induced perturbation of the index of refraction can be determined by the solution of the wave equation in the interference region together with the Boltzmann kinetic equation for gas.

Monday
**September 24, 2012**
Starts at 12:15 PM
Physics Conference Room, SB B326