

# Nanotechnology Seminar Series

“Second Harmonic Generation in Spatially Inhomogeneous Metamaterials ”



4/22/2011

BRK, ROOM 2001, 1:30 PM

**Dr. Ildar Gabitov**  
**University of Arizona**

We studied the process of second harmonic generation in metamaterials responding with a different sign of the refraction index to a pump field and to its second harmonic. Characteristics of a second harmonic generation in homogeneous metamaterials depend on a phase mismatch. In conventional dielectrics, optical fields are periodically varying along the sample if the phase mismatch is nonzero. The fields exhibit monotonic behavior in the ideal case of a zero mismatch. In the last case the energy flows unidirectionally from the pump to the second harmonic wave which leads to high conversion efficiency. The direction of energy flow varies along the sample if phase mismatch is nonzero. We demonstrated that in contrast to conventional dielectrics, unidirectional energy transfer takes place not only for a single zero value of a phase mismatch but also for an entire interval of phase mismatch values. Boundaries of this interval determine critical values of a phase mismatch which separate periodic behavior from monotonic behavior. We studied second harmonic generation in inhomogeneous metamaterials when the value of the phase mismatch changes gradually along a sample and crosses its critical value. In this case both regimes of second harmonic generation are present in the same sample. We analyzed transient effects, the distributions of the fundamental and second harmonic fields, conversion efficiency, and the influence of losses.

Dr. Ildar Gabitov Graduated in 1974 with a diploma in mathematical physics from the Department of Physics, St. Petersburg State University; PhD in theoretical and mathematical physics from L.D. Landau Institute for Theoretical Physics 1982. Employment: Institute of Mathematics (head of laboratory), Academy of Sciences Kyrgyzstan, Landau Institute for Theoretical Sciences (Scientific deputy director, Leading researcher), University of Dusseldorf (senior researcher), Los Alamos National Laboratory (staff member, project leader), University of Arizona (Professor), SMU (/Clements/ Professor). Exhibitions: EXPO'98, CEBIT'97

Host: Vladimir Shalaev, [shalaev@purdue.edu](mailto:shalaev@purdue.edu), 494-9855

[nano.purdue.edu](http://nano.purdue.edu)