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NEWSLETTER

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Energy Concentrating Phenomena: from Sonoluminescence to Crystal Fusion

April 11, 2006

Seth Putterman
UCLA

Date: Tuesday, April 11, 2006

Time: 6:00 pm - Social
6:30 pm - Dinner
7:30 pm - Presentation

Place: Alfio's La Trattoria
4515 Willard Avenue
Chevy Chase, Maryland 20815
(301) 657-9133
http://alfios.com

RSVP: chair@asm-dc.org
(703) 218-1237 (leave a message)
by 9pm Monday, April 10
with meal choice

Cost: $20 for Dinner (Student Rate $10)

Abstract:

Fluids and solids that are driven off equilibrium do not relax smoothly to equilibrium. Instead they display a wide range of energy focusing phenomena. In sonoluminescence a pulsating bubble concentrates the ambient acoustic energy density by 12 orders of magnitude to create picosecond flashes of broadband ultraviolet light. At the minimum bubble radius where the contents have been compressed to their van der Waals hard core the acceleration exceeds 10 11g and a Mega-Bar level shock wave is emitted into the surrounding fluid. For single bubbles driven at 30KHz SL is nature's smallest blackbody. These bubbles are used to facilitate various surgical procedures. At 1MHz the spectrum resembles Bremstrahlung from a transparent plasma with a temperature ~1MK and a nanometer radius. Whether cavitating systems will reach energy densities that initiate thermonuclear fusion is an open question that is in the news. Ferroelectric crystals, however, can be configured to create nuclear fusion in a palm-sized apparatus. When the temperature of a ferroelectric crystal [e.g. Lithium Tantalate] is slightly varied, electrons are expelled with energies that can exceed 100KeV. By configuring the crystal surface with a tip, pyroelectricity can be used to generate and accelerate ions to energies where nuclear fusion occurs. Hoped-for applications range from miniature x-ray devices to neutron cameras.

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