2:15

2pPA4. Evidence for nuclear emissions during neutron seeded acoustic bubble cavitation. R. P. Taleyarkhan, C. D. West, J. S. Cho (Oak Ridge Natl. Lab., P.O. Box 2009, Bldg. 9204-1, Oak Ridge, TN 37831), R. T. Lahey, Jr., R. C. Block (Rensselaer Polytechnic Inst., Troy, NY), and R. Nigmatulin (Russian Acad. of Sci., Ufa, Russia)

In cavitation experiments with deuterated acetone, statistically significant tritium decay activity above background levels was detected. In addition, evidence for statistically significant neutron emissions near 2.5 MeV was also observed, as would be expected for deuterium–deuterium fusion. Control experiments with normal acetone did not result in tritium activity or neutron emissions. Hydrodynamic shock code simulations supported the observed data and indicated compressed, hot (10^6–10^7 K) bubble implosion conditions, as required for thermonuclear fusion reactions. Separate experiments with additional fluids are under way and results appear to support those observed with acetone. Scalability potential to higher yields, as well as evidence for neutron−tritium branching ratios are presented.

2:40–3:00 Break

Contributed Papers

3:00

2pPA5. Dispersion relation measurements of acoustic waves in bubbly water. Gregory J. Orris and Michael Nicholas (Naval Res. Lab., 4555 Overlook Ave. SW, Washington, DC 20375)

Recent theoretical work on the propagation of acoustic waves in bubbly media has highlighted the need for more precise and modern measurements of the relationship between the phase speed and attenuation in bubbly media. During the engineering tests of the new Salt-Water Tank Facility at the Naval Research Laboratory measurements of the dispersion of acoustic waves in fresh water were performed over a broad range of environmental conditions under semi-free field conditions. Large aquaculture aeration tubes were used to create bubble clouds completely filling the facility with bubbles whose radii ranged from a few tens of microns to 1 cm with total void fractions that reached to a few percent. We discuss these experimental results within the context of current theories and their implications on ocean acoustic experiments. [Work supported by ONR.]

3:15

2pPA6. Hydroacoustical interaction of bubble clouds. Stefan Luther and Detlef Lohse (Phys. of Fluids, Faculty of Appl. Phys., Univ. of Twente, The Netherlands)

Acoustically driven cavitation bubble fields consist of typically 10^4 micron-sized bubbles. Due to their nonlinear hydroacoustical interaction, these extended multiscale systems exhibit the phenomenon of spatiotemporal structure formation. Apart from its significance for the theory of self-organization, it plays a major role in design and control of many industrial and medical applications. Prominent examples are ultrasound cleaning, sono-chemistry and medical diagnostics. From a fundamental point of view the key question to ask is ''How does the fast dynamics on small length scales determine the global slow dynamics of the bubble field?'' To clarify the complex interplay of acoustical and hydrodynamical forces acting on the bubbles, we employ high-speed particle tracking velocimetry. This technique allows the three-dimensional reconstruction of the bubbles' trajectories on small and fast scales as well as the measurement of the bubble density on large and slow scales. A theoretical model is derived that describes the nonlinear radial and translational dynamics of the individual bubbles and their interaction. The numerical solution of this N body problem is presented.

3:30

2pPA7. Phase velocity measurements in a bubble swarm using a fiber optic sensor near the bubble resonant frequency. Stanley A. Cheyne (Dept. of Phys. and Astron., Hampden-Sydney College, Hampden-Sydney, VA 23943)

Acoustic phase velocity measurements of a bubble swarm in a cylindrical tube have been made with a fiber optic sensor. The fundamental design of this system is similar to one used in a previous experiment [S. A. Cheyne *et al.*, ''Phase velocity measurements in bubbly liquids using a fiber optic laser interferometer,'' J. Acoust. Soc. Am. **97**, 1621 (1995)]. This new system is more robust and is more easily constructed than the previous system. Results will be presented that will show conclusively that data have been obtained just after the bubble resonance in the regime where the attenuation of sound is very high. Other results will be presented at different air-to-water ratios (void fraction).

3:45

2pPA8. Statistical characteristics of cavitation noise. Karel Vokurka (Phys. Dept., Tech. Univ. of Liberec, Halkova 6, CZ-461 17 Liberec, Czech Republic, karel.vokurka@vslib.cz)

Cavitation noise originates as a superposition of pressure waves emitted during oscillations of individual cavitation bubbles. These pressure waves contain useful information on bubbles generating them and efforts are done to extract it. Unfortunately the pressure waves emitted by different bubbles usually overlap heavily and thus in experiments it makes sense to measure statistical characteristics only. Typical statistical characteristics determined experimentally encompass autospectral densities and instantaneous autospectra. To be able to extract information concerning the oscillating bubbles, suitable models of both cavitation bubbles and cavitation noise are necessary. It has been found out recently that a reasonable insight into the cavitation noise structure may be obtained by simulating cavitation noise on a computer and comparing statistical characteristics of simulated cavitation noise with those determined experimentally. By varying different parameters in theoretical models used to simulate the noise, a good agreement between the simulated and measured cavitation noise statistical characteristics can be obtained. The models parameters thus found may be then analyzed from a physical point of view and conclusions on behavior of cavitation bubbles can be drawn. [Work supported by the Ministry of Education of the Czech Republic as the research Project No. MSM 245100304.]

4:00

2pPA9. Time-scales for quenching single-bubble sonoluminescence in the presence of alcohols. Jingfeng Guan and Thomas Matula (Appl. Phys. Lab., Univ. of Washington, 1013 NE 40th St., Seattle, WA 98105)

A small amount of alcohol added to water dramatically decreases the light intensity from single-bubble sonoluminescence [Weninger *et al.*, J. Phys. Chem. **99**, 14195–14197 (1995)]. From an excess accumulation at the bubble surface [Ashokkumar *et al.*, J. Phys. Chem. **104**, 8462–8465 (2000)], the molecules evaporate into the bubble interior, reducing the effective adiabatic exponent of the gas, and decreasing the bubble temperature and light output [Toegel *et al.*, Phys. Rev. Lett. **84**, 2509–2512 (2000)]. There is a debate as to the rate at which alcohol is injected into the bubble interior. One camp favors the notion that molecules must be repetitively injected over many acoustic cycles. Another camp favors the notion that most quenching occurs during a single collapse. An experiment has been conducted in order to resolve the debate. Quenching rates were measured by recording the instantaneous bubble response and corresponding light emission during a sudden increase in pressure. It was found that