

Final Exam
UNIVERSITY OF TORONTO
Faculty of Arts & Science
APRIL/MAY EXAMINATIONS 2002
PHY 357H1S
Duration - 3 hours

This exam has 4 pages.

Allowed aids: Calculator and 2 letter-sized double-sided hand-written aid sheets.

Do 4 of 5 questions; each question has equal weight.

Each part of a multipart question is of equal weight.

If you do all 5 questions, your best 4 marks will be used.

Show your work and reasoning; part marks will be given.

Some of the following numerical constants may be useful:

...

Cold Fusion Lives?

Regular conferences (e.g. <http://www.altenergy.org/4/iccf8/iccf8.html>,
<http://iccf9.global.tsinghua.edu.cn>)

Cold Fusion Times: <http://world.std.com/~mica/cft.html>

Infinite Energy magazine: <http://www.mv.com/ipusers/zeropoint/index.html>
(includes a wide variety of fringe over-unity and free energy ideas)

...

Sonoluminescence driven hot fusion

...

1992: Steve Jones: sci.physics.fusion 10 December 1992

...

1994: Putterman Patent Application

...

1996: Moss Simulation

“Sonoluminescence and the prospects for table-top micro-thermonuclear fusion”,
William C. Moss, Douglas B. Clarke, John White, David Young, Physical
Review Letters A, 211 (1996) 69-74.

1996: “Chain Reaction” released (<http://www.sciam.com/askexpert/physics/physics28.html>)

...

1999: Impulse Devices incorporated (<http://www.sonofusion.com>)

...

2002: Oak Ridge National Lab results published (Science 295 (2002) 1868.)

...



US PATENT & TRADEMARK OFFICE

(<http://www.uspto.gov/>)

United States Patent 5,659,173

Putterman , et al. August 19, 1997

Converting acoustic energy into useful other energy forms

Abstract

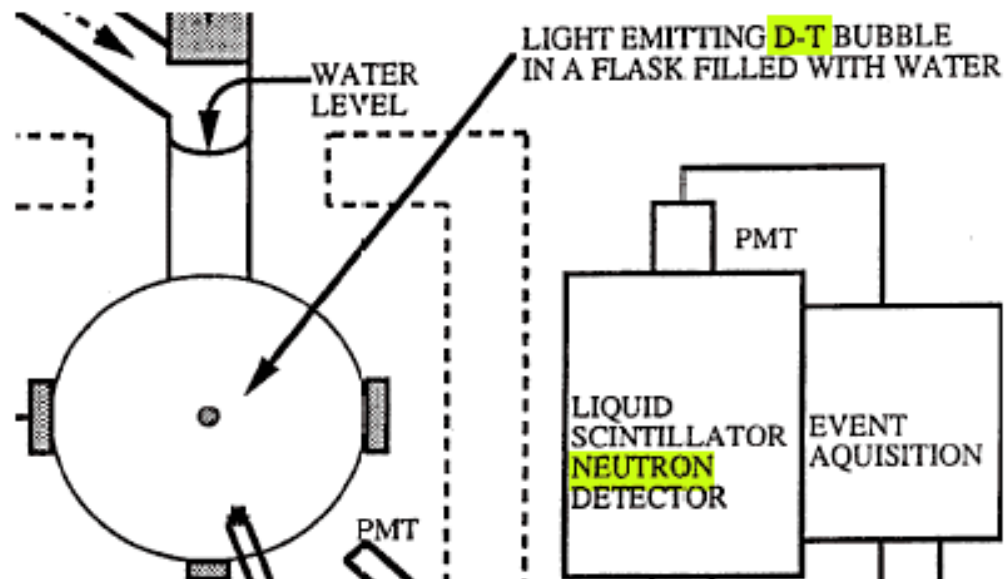
Sonoluminescence is an off-equilibrium phenomenon in which the energy of a resonant sound wave in a liquid is highly concentrated so as to generate flashes of light.

... Different energy forms than light can be obtained from the converted acoustic energy. When the gas contains deuterium and tritium there is the feasibility of the other energy form being *fusion*, namely including the generation of neutrons. ...

Inventors: **Putterman;**
Seth J. (Sherman Oaks, CA); ...

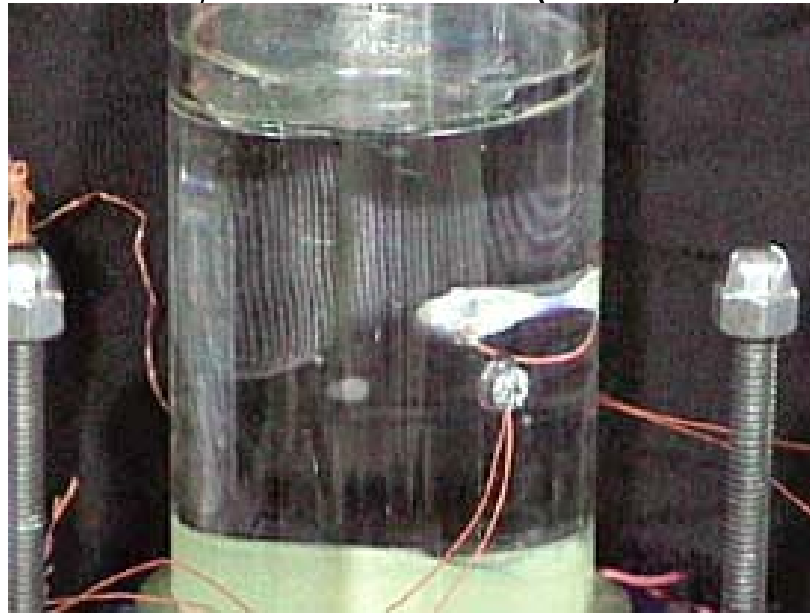
Assignee: **The Regents of the University of California** (Oakland, CA)

Filed: **February 23, 1994**

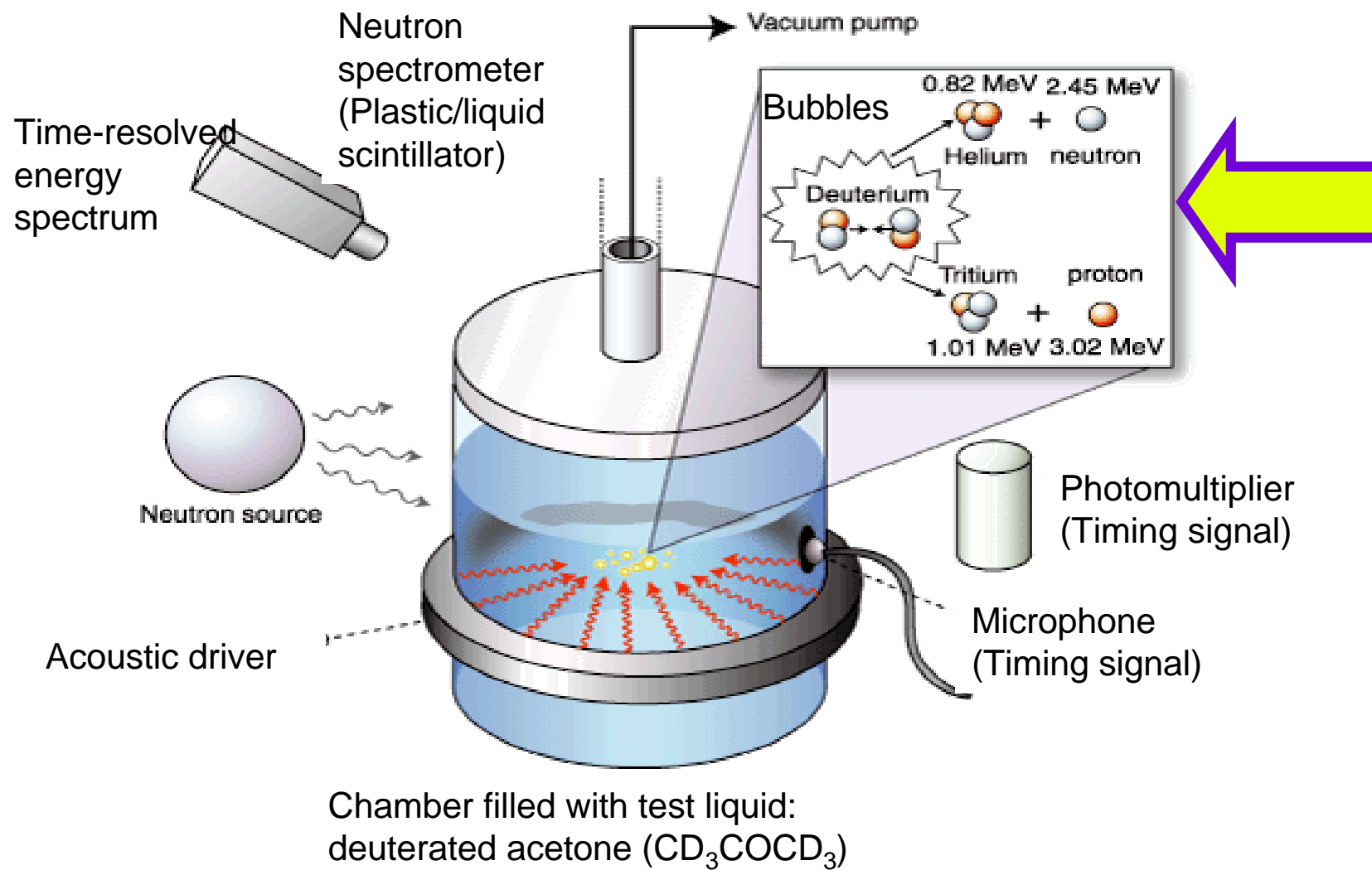


Evidence for Nuclear Emissions During Acoustic Cavitation

R.P.Taleyarkhan, C.D.West, J.S.Cho, R.T.Lahey Jr., R.I.Nigmatulin, R. C.Block, Science 295 (2002) 1868.



“In cavitation experiments with deuterated acetone, tritium decay activity above background levels was detected. In addition, evidence for neutron emission near 2.5 million electron volts 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 highly compressed, hot (10^6 to 10^7 kelvin) bubble implosion conditions, as required for nuclear fusion reactions.”



<http://www.sciencemag.org/cgi/reprint/295/5561/1808.pdf>,
<http://www.sciencemag.org/cgi/reprint/295/5561/868.pdf>

Comments on Reported Nuclear Emissions During Acoustic Cavitation

D. Shapira and M. J. Saltmarsh*

Physics Division†, Oak Ridge National Laboratory

** former Director of Fusion Energy Division*

(<http://www.ornl.gov/slsite/SLan5av2.pdf>)

“We have repeated the experiment of Taleyarkhan *et al.* in an attempt to detect the emission of neutrons from d-d fusion during bubble collapse in deuterated acetone. Using the same apparatus, a more sophisticated data acquisition system, and a larger scintillator detector, we find no evidence for 2.5-MeV neutron emission correlated with sonoluminescence from the collapsing bubbles.”

† Taleyarkhan *et al.* are Nuclear Engineers, experts on thermal and hydraulic aspects of reactors. They are concerned that “People are worried about the impact these poor little coffee cups are going to make on the Tokamak.”

(<http://www.villagevoice.com/issues/0210/baard.php>)

COMMENTS ON THE SHAPIRA AND SALTMARSH REPORT

R. P. Taleyarkhan, R.C. Block, C.D. West and R. T. Lahey, Jr.

<http://www.rpi.edu/~lahey/SciencePaper.pdf>

“We have carefully reviewed the data and report of Shapira and Saltmarsh. Our analysis of these data indicates that, **contrary to their conclusions, a statistically significant increase of nuclear emissions was actually detected by them** during cavitation experiments with chilled deuterated acetone.”

