

Rusi P. Taleyarkhan



Education:

Ph.D. – Nuclear Engr., Rensselaer Polytechnic Institute (1982)
M.B.A. – Business Administration, Rensselaer Polytechnic Institute (1980)
M. S. – Nuclear Engr. & Science, Rensselaer Polytechnic Institute (1978)
B. Tech. – Mechanical Engr., Indian Institute of Technology, India (1977)

Professional Background:

2003 – Present: Arden Bement Professor of Nuclear Engr., Purdue University
1988 – 2003: Distinguished Scientist, Oak Ridge National Laboratory
1984 – 1988: Senior Engineer, Westinghouse Electric Corporation
1984 – Present: Consultant to IAEA, Westinghouse, ABB, S.Levy, Inc., Impulse Devices Inc., Qynergy Corp., NFI, JAERI
1990 – 2000: Editor, Nuclear Safety Journal

Honors / Awards:

2006 – Honorary Fellow (Russian Academy of Sciences)
2004 – Distinguished Engineer of the Year (USDOE/ORNL – 1/3 finalists)
1999 – Fellow, American Nuclear Society
Present – Over 150 publications; Over 20 patent/invention awards

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COLLABORATION TEAM

- Prof. R. T. Lahey, Jr., Edward Hood Jr. Professor, Rensselaer Polytechnic Institute
- Prof. R. I. Nigmatulin, President, Russian Academy of Sciences; Consultant- Purdue
- Prof. G. Hewitt, Imperial College, London, UK
- Prof. W. Bugg, University of Tennessee / Stanford, USA
- Dr. F. Gaitan / R. Tessien, Impulse Devices Inc.
- Dr. Y. Xu, Research Scientist, School of Nuclear Engineering, Purdue University
- Dr. C. D. West (Retd. Oak Ridge National Labs., consultant – Purdue University)
- J. Lapinskas, Graduate Student, School of Nuclear Engineering, Purdue University
- P. Smagacz, Graduate Student, School of Nuclear Engineering, Purdue University
- P. Shaw, Pre-Graduate Student, School of Nuclear Engr., Purdue
- J. Webster, Undergraduate Student, School of Nuclear Engr., Purdue
- Dr. J. S. Cho, Research Scientist, Oak Ridge National Laboratory

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Research Objectives

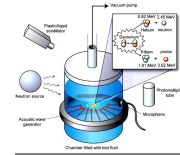
- Scale up **Acoustic Inertial Confinement Thermonuclear Fusion**
- Fundamentals of **Acoustically-Driven Tension Metastable Liquid States**
- Photoacoustics
- Sonoluminescence & acoustic cavitation
- Prevent-delay liquid cavitation (under extreme tension states)
- Acoustically-driven fluid fragmentation/atomization/combustion
- Impact of ionizing radiation on acoustic tensioned metastable states
- Nano-to-macro scale energy storage and on-demand release in acoustically tensioned metastable fluids
- Acoustically-controlled hydrogen production during electrolysis

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Methodologies Used

Experimental

- Acoustic-driven extreme states of compression (1000 Mbar; 10^8 K) and studies of thermonuclear fusion signatures
- High-powered resonant mode acoustic cells developed - -
- Studies on nuclear particle-cum-laser-cum-mechanical stimulus based nucleation of sub-nano scale bubbles
- Acoustic signatures of imploding multi-bubble clusters
- Photon, neutron, alpha particle detection systems using combination of acoustic, centrifugal and bertholet methods



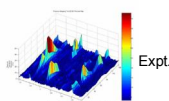
Analytical

- FE models for fluid-structure interaction dynamics in resonant acoustic test cells (harmonic, modal & transient simulations)
- Shock modeling and simulation for imploding bubble clusters (with RAS, and RPI)
- Nuclear particle transport modeling and simulations in acoustic systems

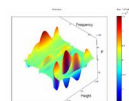
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Results (Success) Summary

- Thermonuclear fusion state attainments** (measured 2.45 MeV neutrons, gammas, and tritium) during acoustically driven cavitation of deuterated liquids (Science-2002; Phys.Rev.E.-2004; PRL-2006)
** Impact on Energy; Homeland Security; Materials Synthesis; Cancer Therapy, Fundamental Probe for the Sub-Atomic Universe **
- Developed (with RAS, RPI) theory of acoustically driven **Supercompression** (Phys.Fluids, 2005)
- **Ability to detect neutrons (eV to MeV) spectral range** – first time in history that any detector system can cover x 1,000,000 energy range in single system
** Impacts on SNM detection; Fundamental Physics Probe
- Detection of ns duration (UV) photons in tensioned inorganic-organic fluids**
- **3-D Predictive capability for fluid-structure response in resonant acoustic cavities**



Expt.



Simulation

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Future Directions (selected)

Multi-Disciplinary Teaming for enabling **Scale-Up of Acoustically-driven Inertial Confinement Fusion** systems for attaining breakeven-net energy generation

- Paradigm shift impact value on Energy landscape
- ** Voted by EETimes (8/2005): **World's Top 10 Must-Do R&D Projects ****

Acoustic based low-cost nuclear particle detection systems

- Potential for radical transformations (cost, reliability and sensitivity) in ability to conduct interrogation of hidden explosives, contraband, special nuclear materials, and fundamental physics studies

Acoustic energy stimulation of hydrogen evolution during Electrolysis

- Potential for significant impacts on hydrogen economy

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