PLASMAS AND MEGAGAUSS FIELDS

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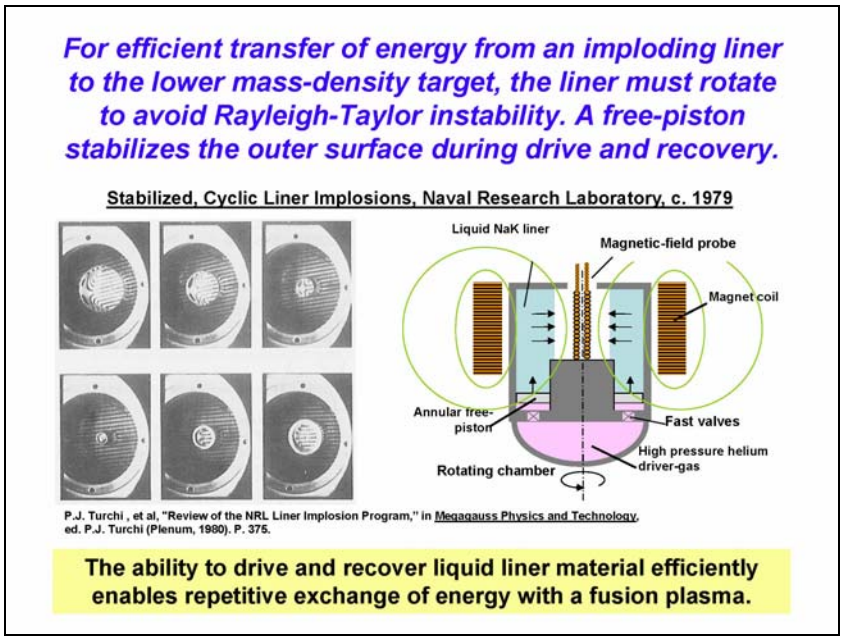
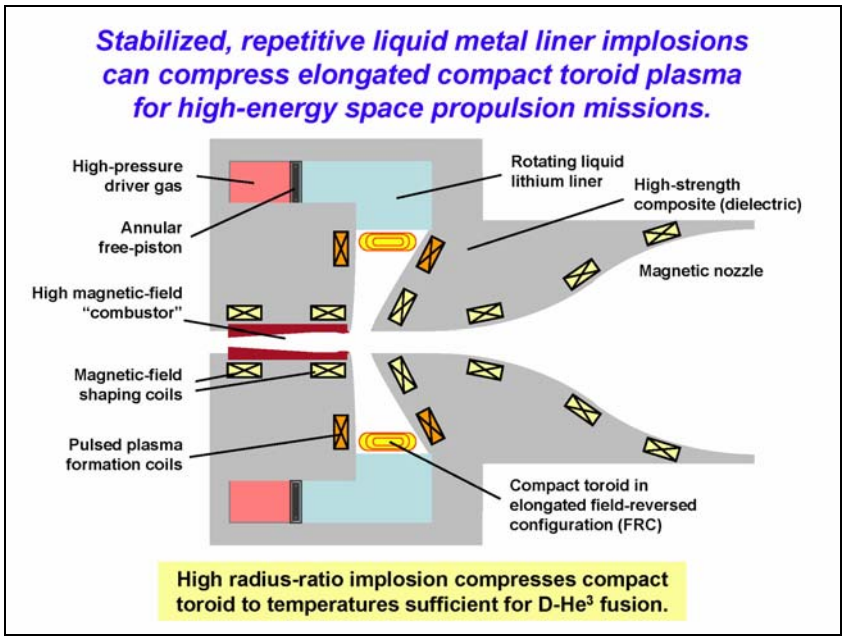
IEEE Distinguished Lecturer
Santa Fe, NM

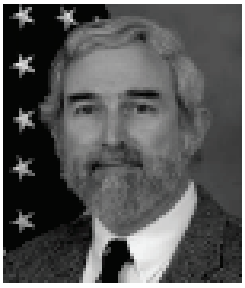
Megagauss magnetic fields interact with plasma both in the generation of high energy-density states of matter and in the use of magnetized plasma in multi-megampere pulsed power devices. The present lecture provides a brief theoretical framework, in the limits of high magnetic Reynolds number and high magnetic pressure compared to plasma pressure, for subsequent discussions of several applications. These applications include imploding plasma liners, the plasma flow switch and radiator, and controlled thermonuclear fusion. We examine issues of energy transport, surface interactions, stability, and technology choices. Notions of high magnetic fields enabling advanced space propulsion concepts for fast missions to the outer planets are also considered.





Peter J. Turchi

Bio for IEEE Distinguished Lecture



Peter J. Turchi received his professional education (BSE, 1967, MA, 1969, PhD, 1970) in aerospace and mechanical sciences at Princeton University. On active duty (1970-1972) at the Air Force Weapons Laboratory, Kirtland Air Force Base, NM, he initiated programs on soft X-ray generation by multi-megampere-driven plasma implosions and explosively-driven, magnetic-flux compression generators. As a civilian scientist at the Naval Research Laboratory, Washington, DC, he headed the Plasma Technology Branch (1976-1980). Dr. Turchi became director of the Washington Research Laboratory of R&D Associates, Inc. in 1981 and led projects on high energy-density pulsed power for nuclear weapons simulation, space propulsion and missile defense. In 1989, he was appointed professor of aerospace engineering at The Ohio State University, where he taught and conducted research on advanced space propulsion. In 1999, Dr. Turchi joined Los Alamos National Laboratory, where he led the development of pulsed power and liner implosion experiments. He returned to the Air Force in 2002, as the Senior Scientist for High Power Microwaves and Pulsed Power. In 2005, he resumed and extended his activities at Los Alamos, retiring in 2011. Dr. Turchi is a Fellow of both the AIAA and IEEE. He has been a member and past chair of the AIAA Electric Propulsion Technical Committee and the IEEE Standing Committee on Pulsed Power Science and Technology, and President of the Electric Rocket Propulsion Society. He has received the IEEE Erwin Marx Award for pulsed electrical power science and technology, the ERPS Award for service to electric propulsion, and the A.D. Sakharov medal, the A.I. Pavlovsky prize and the Megagauss Award for his contributions to megagauss physics and technology.

Education

1967 Bachelor of Science in engineering, aerospace and mechanical sciences, Princeton University, Princeton, New Jersey.

1969 Master of Arts, aerospace and mechanical sciences, Princeton University.

1970 Doctor of Philosophy, aerospace and mechanical sciences, Princeton University.

Work Experience

1963–1970, research associate, Princeton Plasma Propulsion Laboratory, Princeton University, Princeton, New Jersey.

1970–1972, laboratory plasma physicist, Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico.

1972–1980, group leader, Imploding Liner Group, Naval Research Laboratory, Washington, D.C.

1976–1980, chief, Plasma Technology Branch, Naval Research Laboratory, Washington, D.C.

1980–1989, senior scientist, R&D Associates, Inc., Arlington, Virginia.

1981–1989, director, RDA Washington Research Laboratory, Alexandria, Virginia.

1988, adjunct professor of aerospace engineering; 1999–2002; The Ohio State University, Columbus, Ohio.

1989–1999, professor of aerospace engineering, The Ohio State University, Columbus, Ohio.

1996–1997, visiting chief scientist for Advanced Weapons and Survivability, Air Force Phillips Laboratory, Kirtland Air Force Base, New Mexico.

1999–2001, team and project leader for hydrodynamics and pulsed power science; 2005-present, team leader; Los Alamos National Laboratory, Los Alamos, New Mexico.

2002–2005, senior scientist for high power microwaves and pulsed power, Air Force Research Laboratory, Directed Energy Directorate, Kirtland Air Force Base, New Mexico.

Areas of Expertise

Pulsed power, electric rocket propulsion, high-energy density physics, high magnetic fields, gas dynamics, plasma dynamics, aerospace engineering, directed energy, thermonuclear fusion.

Professional Affiliations and Awards

Fellow, American Institute of Aeronautics and Astronautics; Fellow, Institute of Electrical and Electronics Engineers; President, Electric Rocket Propulsion Society; Chair, numerous national and international technical conferences; IEEE Erwin Marx Award for Outstanding Contributions to Pulsed Power Science and Technology; Air Force and Navy Invention Awards.