テキサス大学オースチン校ホームページ

バーク教授

# Herbert L. Berk
# Professor, The Institute for Fusion Studies

ハーバート.L.バーク核融合研究所教授

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## Teaching Home

## Research

The research specialty of Professor Herbert L. Berk is in the discipline of plasma physics, with particular application to developing an energy source from nuclear fusion.

He was the editor of the pamphlet the "Pervasive Plasma State" , that describes the scope of research areas and technology in plasma research. Please press the following link, immediately below, if you wish to examine this pamphlet .

Pervasive Plasma State

His current topic of research, is motivated by the need to understand the dynamics of alpha particle containment in fusion producing experiments. These particles can spontaneously excite plasma waves, such as Alfven waves, that may cause alpha particles to be lost prematurely from a fusion machine. To study this problem there was a need to expand the basic understanding of the resonant wave-particle interaction. The generality of this topic leads to new fundamental descriptions of nonlinear phenomena associated with the wave-particle interaction. If you wish to obtain a flavor of this work, please click the following link for an overview discussion and a selection of figures of the advances made by Professor Berk and his collaborators in the last few years.

Basic Nonlinear Wave Particle Interaction

ハーバート.L.バーク教授はプラズマ物理学を専門分野とし、特に核融合反応によるエネルギー源の発展に力を注いできた。
□
※注記：尚、次頁以下に示すように、当該論文を審査した米国物理学会誌「フィジカル　レビュー　レター」のプラズマ物理学専門分野エディターとして活躍されましたが、**今回頂戴した米国からの３名の筑波大学長宛書類の筆頭が、このハーバート.L.バーク教授であり、当該書類が「フィジカル　レビュー　レター掲載論文の取り下げの必要はない」旨の文面であることに特に御留意下さい。**

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Princeton University

PPPL


***Nathaniel J. Fisch***

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***Fax: (609) 243-2662***

***E-mail: fisch@princeton.edu***


Nathaniel J. Fisch is Director of the Program in Plasma Physics and Professor of Astrophysical Sciences at Princeton University. He serv as Associate Director for Academic Affairs at the Princeton Plasma Physics Laboratory (PPPL) . He is also the Academic Director for the I Undergraduate Summer Fellowship Program in Plasma Physics and Fusion Engineering. In 1998, Fisch was the Chair of the Division of Physics of the American Physical Society.

Professor Fisch's professional interests include plasma physics with applications to nuclear fusion, plasma processing, plasma devices, lase astrophysics; plasma thrusters, laser-based plasma accelerators, and atomic radiation in plasmas; complex liquids and co electrohydrodynamics; petroleum refining; statistical inference and pattern recognition.


Department of Astrophysical Sciences
Princeton Plasma Physics Laboratory
James Forrestal Campus
Princeton University
Princeton, NJ 08543


ナサニエル　J. フィッシュ教授は米国プリンストン大学のプラズマ物理学プログラム ディレクター、宇宙物理学教授、プリンストン プラズマ物理学研究所のアカデミック関連の副ディレクターとして奉職している。
フィッシュ教授は1998年アメリカ物理学会のプラズマ分野議長であり、（次頁に示すように）米国物理学会から2005年に権威あるマックスウェル賞を受賞した。

This website is maintained by Jennifer Jones

6,092

PPPL PRINCETON PLASMA PHYSICS LABORATORY news release
U.S. Department of Energy's Princeton Plasma Physics Laboratory
JAMES FORRESTAL CAMPUS, P.O. BOX 451, PRINCETON, NJ 08543

**17 October 2005**

(To download a print-quality photo file of Dr. Fsich, go to the end of this article.)

# PPPL's Fisch to Receive Maxwell Prize

**Plainsboro, New Jersey** — Nathaniel Fisch, a professor at Princeton University and a scientist at the U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL), has been named the 2005 recipient of the American Physical Society's James Clerk Maxwell Prize for Plasma Physics. The prize recognizes Fisch for his outstanding contributions to the field of plasma physics. It will be given at the APS-Division of Plasma Physics annual meeting in Denver this month. Fisch is cited "For theoretical development of efficient radio frequency-driven current in plasmas and for greatly expanding our ability to understand, to analyze, and to utilize wave-plasma interactions."

Fisch is best known for his predictions of new ways to drive electric current in hot, magnetized plasma by means of electromagnetic waves, and for his analyses of techniques to use radio waves to drive electrical currents in plasmas. Plasma is a hot, ionized gas that serves as the fuel for nuclear fusion. These wave-induced currents can enable fusion reactors, called tokamaks, to operate continuously, which is necessary for an economical and practical fusion reactor. These currents are now being employed also to control the heat and particle transport in fusion devices around the world. In his recent research, Fisch is also exploring plasma-based methods of generating extreme laser intensities, plasma thrusters and related plasma devices, and new fusion concepts employing magnetically or inertially confined plasma.

PPPL Director Rob Goldston said, "Professor Fisch's work on radio frequency waves and their application to driving currents in plasmas has changed the face of international fusion research, making it possible to contemplate fusion systems that operate fully steadily, rather than in short pulses. In many ways the research agenda of the last decade in fusion plasma physics has only been made possible by Nat's insights."

Fisch is Professor of Astrophysical Sciences and Director of the Program in Plasma Physics at Princeton University. He also is an Associated Faculty in the Department of

Mechanical and Aerospace Engineering. At PPPL, he is the Associate Director for Academic Affairs and the Head of the Laboratory's Hall Thruster Experiment.

Scott Tremaine, Chair of Princeton University's Department of Astrophysical Sciences, said, "Nat Fisch is not only an exceptional theoretical physicist but also is committed to the fulfillment of PPPL's unique role in the training of the next generation of plasma physicists, and to strengthening the interactions between PPPL and the University research community. Nat's work exemplifies the benefits that accrue to both communities from close cooperation between universities and national labs."

Fisch studied electrical engineering and computer science at the Massachusetts Institute of Technology (MIT), where he was an MIT National Scholar. He received a B.S. degree in 1972, an M.S. degree in 1975, and a Ph.D. in 1978. He received an E.O. Lawrence Award in 2004, a Guggenheim Fellowship in 1985, the 1992 APS Award for Excellence in Plasma Physics, and a Department of Energy Bronze Medal for Outstanding Mentor 2002. Fisch is the author or co-author of more than 200 research papers and has been granted nine U.S. patents. He is a resident of Princeton Borough.

The James Clerk Maxwell Prize for Plasma Physics, presented annually, consists of $5,000 and a certificate citing the contributions made by the recipient. It was established in 1975 by the Maxwell Technologies, Inc., in honor of Scottish physicist James Clerk Maxwell and is presently sponsored by General Atomics. The prize shall be for outstanding contributions to the advancement and diffusion of the knowledge of properties of highly ionized gases of natural or laboratory origin. The prize shall ordinarily be awarded to one person but a prize may be shared when all the recipients have contributed to the same accomplishments.

Past PPPL recipients of the Maxwell Prize include Russell Kulsrud in 1993, Harold Furth in 1983, Thomas Stix in 1980, and Lyman Spitzer in 1975.

PPPL, funded by the U.S. Department of Energy and managed by Princeton University, is a collaborative national center for science and innovation leading to an attractive fusion energy source. Fusion is the process that powers the sun and the stars. In the interior of stars, matter is converted into energy by the fusion, or joining, of the nuclei of light atoms to form heavier elements.

End

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**Downloadable print-quality photo** of:

Dr. Nathaniel Fisch Resolution is 300 dpi, print size is approximately 3.6 inches wide by 4.6 inches high, file type is jpeg, and file size is 1.1 MB. Photo by Elle Starkman.

PPPL is funded by the U.S. Department of Energy
and managed by Princeton University.

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Created: 17 October 2005
Send questions or comments to:
Anthony R. DeMeo at ademeo@pppl.gov

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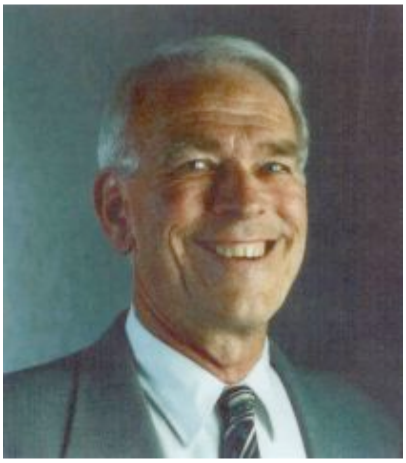
トーマス C. シモーネン



Thomas C. Simonen, Class of 1960

Following graduation Tom Simonen went on to receive a Ph.D. in electrical engineering from Stanford University. After appointments at Hughes Aircraft, Max Planck Institute in Munich, and Princeton University, he joined the Lawrence Livermore National Laboratory for 18 years as a physicist and became program leader for magnetic fusion experiments. For the past 12 years he has been Director of the DIII-D National Fusion Program, the U.S. Department of Energy's largest fusion facility with over 50 collaborating laboratories and universities. Dr. Simonen has published extensively in the field nuclear fusion energy, served on numerous national and international physics committees, and is a Fellow of the American Physical Society.

〔要約〕トーマスC.シモーネン博士は米国スタンフォード大学で博士号取得後、ドイツミュンヘンのマックスプランク研究所、プリンストン大学等を経て、米国ローレンスリバモア国立研究所の磁場核融合実験のプログラムリーダー（ディレクター）として１８年間活躍した。また、米国エネルギー省最大の核融合装置であるＤ３Ｄトカマクのディレクターとして最近１２年間活躍をした。また、多くの国際的物理委員会の委員を務め、アメリカ物理学界のフェローの称号を得ている。最近は米国政府の委員会委員長、カリフォルニア大学バークレイ校、ミシガン技術大学等で教鞭をとられた。

*ISSN 1063-780X, Plasma Physics Reports, 2007, Vol. 33, No. 10, pp. 881–882. © Pleiades Publishing, Ltd., 2007.*
*Original Russian Text © by the Editorial Board, 2007, published in Fizika Plazmy, 2007, Vol. 33, No. 10, pp. 859–860.*

※ロシア科学アカデミーによるプラズマ物理学に関する論文誌の巻頭に特別掲載

パスツコフ博士

# Vladimir Pavlovich Pastukhov (In Honor of His 60th Birthday)

PACS numbers: 01.60.+q
**DOI:** 10.1134/S1063780X07100108

ウラディミール　パブロビッチ　パスツコフ
（その６０歳の誕生日を祝して）

On May 28, 2007, we celebrated the 60th birthday of Vladimir Pavlovich Pastukhov, an eminent theoretical physicist, a doctor of physical and mathematical sciences, and a head of the Laboratory of the Theory of Dynamic and Transport Processes at the Russian Research Centre Kurchatov Institute.

Pastukhov is well known in the plasma community as a wide-profile theorist, who contributed greatly to various branches of the physics of high-temperature plasmas: plasma kinetics, stability theory, transport processes, etc. Many of his works, being fundamental in character, are very valuable for practical applications and helpful in interpreting experimental results. This is largely explained by the fact that he began his scientific career as a staff theorist in M.S. Ioffe's experimental laboratory, which became famous for its fundamental studies on the plasma production and confinement in magnetic mirrors. After graduating from the Moscow Engineering Physics Institute, Pastukhov was engaged in studies carried out in Ioffe's laboratory and soon became a coauthor of a number of papers on the stabilization of drift-cone instability, related to the strong anisotropy of the distribution function of plasma particles in velocity space. It was anomalous plasma losses caused by this instability that hampered the development of open magnetic systems at that time. In Ioffe's laboratory, the method for the suppression of drift-cone instability by a small additive of warm ions was thoroughly examined both theoretically and experimentally. Afterwards, a team of scientists, including Pastukhov, was awarded USSR State Diplomas on the discovery of the phenomenon of drift-cone instability.

Among the works that Pastukhov carried out in the 1970s on plasma confinement and stability in open systems, a theoretical problem of particle losses along the magnetic field with allowance for the electric potential, which was correctly formulated and gracefully solved analytically, has brought him world-wide recognition. An expression deduced by Pastukhov for such losses, which is known in the literature as Pastukhov's formula, became an important tool for describing plasma behavior in ambipolar (tandem) mirrors. It is now difficult to find a work related to the plasma production in open systems for scientific or technological purposes that does not use this formula. Pastukhov's studies on MHD plasma stabilization in confinement systems without a magnetic well (due to the effect of plasma compressibility in the presence of a highly nonuniform magnetic field) also received wide recognition. In particular, a dipole-like configuration with an internal conductor, proposed by Pastukhov and A.I. Morozov, was implemented in practice. At present, the method of divertor stabilization is being studied experimentally. Other of Pastukhov's conceptual achievements, also made in the "trap period," are the marginal stability principle and the relevant anomalous transport theory. According to this principle, the profiles of the physical quantities (such as plasma density and temperature) across the plasma column in a magnetic confinement system should be close to the stability margin of the perturbations that are most dangerous under given conditions. Beyond the stability margin, intense anomalous fluxes generated by unstable modes arise that lead to a rapid relaxation of the profile toward the stability margin. This principle was confirmed experimentally in the ATOLL magnetoelectrostatic trap, as applied to the drift low-hybrid and long-wavelength ion-acoustic instabilities inherent in that trap. Similar fundamentally nondiffusive transport processes are typical of modern experiments in large tokamaks.

At present, Pastukhov further develops these ideas with the purpose of elaborating the theory and adequate simulation methods of self-consistent MHD plasma convection and related transport processes in a magnetized plasma of various fusion devices, including tokamaks. He formulated the general principles of correctly reducing complicated MHD equations; in fact, these principles generalize the Van-der-Pole classical method to the case of continuous media. These results also have been confirmed experimentally, in particular, in the GAMMA-10 facility (Tsukuba, Japan).

Pastukhov combines a clear physical understanding of complicated plasma phenomena with the talent of a brilliant analyst. It is very useful to discuss new ideas with him, because his critical remarks are always exact and motivated—a consequence of his 15-year work as a deputy of the editor-in-chief of *JETP Letters.*

The friends and pupils of Pastukhov, as well as the Editorial Board of *Plasma Physics Reports*, congratulate Vladimir Pavlovich with his birthday and wish him robust health and new bright scientific achievements.

2007年5月28日に６０回目の誕生日を迎えたウラジミール　パブロビッチ　パスツコフは、卓越した理論物理学者であり、物理学及び数学の博士号を有し、（世界的に有名な）ロシア研究センター　クルチャトフ研究所のプラズマダイナミックス及び輸送過程の研究室の長として活躍しています。パスツコフはプラズマ研究界において、プラズマ動力学、安定理論、輸送過程など、広範な研究領域を持つ研究者として広く知られています。（中略）パスツコフによって演繹されたこうした損失に関する方程式は、「パスツコフの式」の名で知られており、ambipolar（タンデム）ミラー内におけるプラズマの振る舞いを記述するための大切な道具となりました。

ロシア連邦ノボシビルスク
ロシア科学アカデミー
ブドカー原子物理学研究所

クルグリアコフ教授

ロシア科学アカデミーの大変な栄誉あるアカデミッシャンの称号を持つクルグリアコフ教授は、下記のように2007年までのブドカー原子物理学研究所全体の副所長及びプラズマ研究分野の長として長年活躍され、2008年より同アドバイザーに成られた同所第一の実力者です。

# ⑥ ブトケル核物理学研究所
(ノボシビルスク)

## I. Name of the Institute (Organization)

**In Russian:** Институт ядерной физики имени Г.И.Будкера

**In Russian abriviation:** ИЯФ им.Будкера

**In English:** State Research Centre Of The Russian Federation Budker Institute of Nuclear Physics

**In English Abbreviation:** SRC BINP

## II. Location

**Official adress:** 11,Academician Lavrentyev Ave.,Novosibirsk, 630090,Russia

**Mail adress:** 11,Academician Lavrentyev Ave.,Novosibirsk, 630090,Russia

**Teltphone number:** (383-2)35-60-31

**Fax number:** (383-2)35-21-63

**E-mail for representative:** root@inp.nsk.su

**Access (transportation, necessary time):** Novosibirsk international airport, about one hour by car.

## III. History

The Institute of Nuclear Physics of the Siberian Branch of the Russian Academy of Science was founded in 1958. It came from a laboratory for new methods of acceleration headed by G.I. Budker at the Institute of Atomic Energy at that time under I.V. Kurchatov.

Academician G.I. Budker was the founder and first Director of the Institute. From his death in 1977 to the present time, the Institute's Director has been Academician A.N. Skrinsky. The "Round Table"-the Scientific Council of the Institute-governs the research and other activities of the Institute.

There are three thousand two hundred members of the Institute's staff. There are five hundred researchers, four hundred engineers, nine hundred technicians and workers, and nine hundred machinery shop personnel. Four researchers are full members and five are corresponding members of the Russian Academy of Science, while fifty are Doctors of Science and one hundred and sixty are candidates of Science.

In November 1994, the Russian Government granted the Institute the status of being a State Scientific Center of the Russian Federation with the title of "The G.I. Budker Institute of Nuclear Physics". This honor signifies the worldwide recognition of the Institute's research achievements.

## IV. Management

**Kind of organisation:** State Scientific Center of Rf

**Ownership:** State property of Russian Federation

**Responsible Ministry:** Russian Academy of Sciences Siberian Branch

## V. Executives

A.N.Skrinsky, Director of the Institute

E-mail: skrinsky@inp.nsk.su

Tel.: 97-60,97-61 internal

Tel.: +7 (3832) 35-60-31, 35-59-85

Fax: +7 (3832) 352163

アカデミッシャン　クルグリアコフ教授は、下記のように2007年までのブドカー原子物理学研究所全体の副所長及びプラズマ研究分野の長として長年活躍された同所第一の実力者です。

Administration 管理部

V.V.Anashin, Deputy Director, E-mail:V.V.Anashin@inp.nsk.su

V.E.Balakin, Deputy Director, E-mail:balakin@inp.nsk.su

E.P.Kruglyakov, Deputy Director, E-mail:E.Kruglyakov@inp.nsk.su

E.P.クルグリアコフ教授 前副所長

G.N.Kulipanov, Deputy Director, E-mail:G.N.Kulipanov@inp.nsk.su

V.A.Sidorov, Deputy Director, E-mail:sidorov@inp.nsk.su

A.M.Kudryavtsev, Scientific Secretary, E-mail:A.M.Kudryavtsev@inp.nsk.su

## VI. Current major activites

Some of the main activities of the Institute are given in the following list.

- Elementary particles and nuclear physics;
- Theoretical physics;
- Accelerator physics and techniques;
- Plasma physics and thermonuclear fusion;
- Synchrotron radiation and free electron lasers;
- Collaborations with other institutions

## VII. Number of employee

**Number of employee:** 3.200 .

## VIII. Major facilities

Several detectors for the experiments in High Energy Physics are working now or being under construction.

VEPP-2M collider.

ブドカー原子物理学研究所ホームページ



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Лаборатория 2 (ЛАБ-2)
Лаборатория 3-0 (ЛАБ-3)
Лаборатория 3-1 (ЛАБ-3)
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Лаборатория 5-0 (ЛАБ-5)
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Сектор 9-14 (ЛАБ-9)
Лаборатория 10 (ЛАБ-10)
Лаборатория 11 (ЛАБ-11)
Лаборатория 12 (ЛАБ-12)
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Научно-конструкторский отдел (НКО)
Отдел вычислительных систем (ОВС)
Отдел рад.иссл. и рад.безопасности (АДМ)

Всего 30 научных подразделений

## Дирекция

Director　（部門長一覧）

Тип подразделения: НАУЧ
Глава: Скринский Александр Николаевич

| ФИО | должность |
|---|---|
| Анашин Вадим Васильевич | Зам.дир.по произв-ву |
| Завадский Николай Андреевич | Зам.дир.по общим вопр. |
| Иванов Александр Александрович | Зам.дир. по науке |
| Кудрявцев Андрей Михайлович | Ученый секретарь |
| Кулипанов Геннадий Николаевич | Зам.дир. по науке |
| Левичев Евгений Борисович | Зам.дир. по науке |
| Скринский Александр Николаевич | Директор |
| Тихонов Юрий Анатольевич | Зам.дир. по науке |
| Чуркин Игорь Николаевич | Зам.дир.-главный инженер |

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アメリカ物理学会月刊誌フィジックス･トゥデイより

ディモフ教授

ノボシビルスクブドカー原子物理学研究所のディモフ教授に関する資料（３頁目及び５頁目を参照下さい。）



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## Obituary

**Frederic H. Coensgen**
10 February 1919 - 18 November 2007
Lawrence Livermore National Laboratory
Pleasanton, CA

Submitted by Richard F. Post

Published on 07 December 2007


**Frederic H. Coensgen**

Frederic H. Coensgen, a pioneer of magnetic fusion research, passed away November 18, 2007, age 88, following a short illness.

During a forty-five year career at the Lawrence Livermore National Laboratory, Fred served as group leader and scientific inspiration for a succession of experiments employing the magnetic mirror principle to confine hot plasmas. In the mid 1970 s, he led the 2XIIB experiment that established the principles for stabilizing mirror-confined plasmas that inspired the invention of the tandem mirror at Livermore and Novosibirsk. Based on intense energetic neutral beams to heat the plasma, the launching of 2XIIB in the early 1970 s also led to the development at Lawrence Berkeley Laboratory of the 50 ampere neutral beam sources used to heat the DIIID tokamak at General Atomics and the TFTR at Princeton that achieved the world s first definitive demonstration of controlled fusion energy in the mid 1990's.

Fred was a superb experimental physicist, greatly admired by colleagues for his leadership, dry humor and boldness in tackling new technologies needed for progress. Novel magnetic coils to achieve compressional heating of plasmas led to his first success, culminating in the achievement of temperatures of 3.6 KeV in the Toy Top II device, reported at an international conference at Salzburg in 1961. However, in that same experiment it was found that, following compression, the plasma was terminated by MHD modes of instability. Characteristically, Fred took this setback in stride, and moved on by modifying the shape of the magnetic fields to create a stable magnetic well, a new technique demonstrated by the Soviet plasma physicist Ioffe.

By the early 1970 s, Fred again shifted course, to add neutral beam heating to replace compression. This led to the pace-setting 2XIIB experiment mentioned above. Again, technological innovation played a vital role. As the target plasma for injection, 2XIIB employed the washer stack plasma gun previously used as the starting point for compression. Again, there was first a setback with the occurrence of loss cone instabilities peculiar to mirror machines. Then news arrived from Ioffe in Russia that he had also stabilized these modes, using a principle developed theoretically by Post at Livermore, wherein a supply of cold ions partially fills the loss cone. Realizing at once that improving the vacuum removed cold ions, Fred set out to modify his plasma gun to provide a continuous stream of cold plasma to fill the loss cone during neutral beam injection.

The stream-stabilized 2XIIB was an instant success, yielding in 1975 ion temperatures approaching 20 KeV. This was the highest temperature yet achieved in a controlled fusion experiment of any kind, preceding by three years a similar achievement in the PLT tokamak at Princeton, also using neutral beam injection. Even more impressive was the fact that the combination of a magnetic well to stabilize low frequency MHD instabilities and the plasma stream to stabilize loss cone instabilities led to plasmas stable in every sense. It was these results, together with an analysis of how the stream gun worked, that led Dimov in Novosibirsk and, independently, Fowler and Logan in Livermore, to propose the tandem mirror. By 1976, the remarkable stability of the 2XIIB plasma led to the achievement of plasma pressures in the magnetic well at the ultimate theoretical limit with plasma pressure comparable to magnetic pressure. This inspired a different idea, called the Field Reversed Mirro r.

ノボシビルスクのディモフ教授はリバモアのファウラー及びローガン博士と独立にタンデムミラープラズマ閉じ込め装置形式を提唱した。

In the 1970 s and 1980 s, the U. S. magnetic fusion program exploited successes in 2XIIB to pursue Field Reversed Mirrors in a device called Beta II, and a succession of Tandem Mirror devices beginning with the highly successful TMX experiment at Livermore and the TARA at MIT; the TMX-U employing thermal barriers to enhance confinement; and the large MFTF-B tandem mirror completed in 1986. Coensgen was physics leader for all of those projects that were carried out at Livermore. Though mirror experiments on this scale are no longer pursued in the U. S., tandem mirror programs in Japan and Russia continue Coensgen s legacy.

Fred Coensgen was born in Great Falls, Montana, February 10, 1919. He received his Ph.D. in physics from the University of California, Berkeley. He spent his entire career at the Lawrence Livermore National Laboratory, retiring in 1994. After retirement, he became an accomplished photographer, and enjoyed hiking and family. He is survived by his wife Charlene of Pleasanton, California, 6 children and 9 grandchildren.

T. Kenneth Fowler,
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**Journal of Fusion Energy**
Editor-in-Chief: Stephen O. Dean
ISSN: 0164-0313 (print version)
ISSN: 1572-9591 (electronic version)
Journal no. 10894
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Journal of Plasma Physics (2006), 72: 1133-1137 Cambridge University Press

doi:10.1017/S0022377806005794
Published online by Cambridge University Press 20 Dec 2006

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Papers

# A numerical model for radiofrequency heating of sloshing ions in a mirror trap

**VLADIMIR E. MOISEENKO** [a1][p1] **and OLOV ÅGREN** [a1]
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## Abstract

A newly developed numerical model calculating the distribution and damping of radiofrequency fields by sloshing ions is presented. The model solves time-harmonic Maxwell's equations written in terms of the electric field. It uses a two-dimensional grid and a Fourier series in the third coordinate and is based on a non-staggered mesh not aligned along the steady magnetic field. The numerical stability of the scheme is discussed, and the convergence analysis is presented.

(Received August 14 2005)
(Accepted June 22 2006)

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