students alike. On the other hand, as a supplement or reference, the book has many virtues. Once one begins to feel at home with the formalism of quantum mechanics, the no-nonsense review in Part 1 provides a way of highlighting the key concepts. Further, the collection of detailed examples in Part 2 provides a more useful supplement for the typical text which contains fewer and less complete examples.

The comments to this point have presupposed use in a conventional undergraduate quantum course. For engineering courses, some other possibilities exist. Engineering students, because of their practical bent, often gain their deepest insight into quantum mechanics through applied courses such as a laser or quantum electronics course. The typical quantum electronics text presents numerous applications of QM theory to specific problems related to lasers. Likewise, several popular texts used in nuclear engineering courses on nuclear concepts contain an applied treatment of neutron and charged-particle scattering. However, students still may wish to have a supplemental text for added background and to have at their disposal examples of problems and methodology that covers a wide range of applications. If so, *Wave Mechanics and Its Applications* should receive serious consideration.

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Technology of Controlled Thermonuclear Fusion Experiments and the Engineering Aspects of Fusion Reactors

(Proceedings of a Symposium held at Austin, Texas, November 1972)

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Publisher	Technical Information Center, Office of Information Services, USAEC (April 1974)
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Reviewer	Gerald L. Kulcinski

Critical assessments of conference proceedings are always a difficult process, especially when they contain a large number of diverse papers. This particular proceedings contains 58 papers which vary dramatically in purpose and quality, from philosophical ideas to hard experimental data, from the work of a graduate student on his thesis to the combined efforts of over 20 scientists, and from esoteric conceptual schemes to descriptions of circuit breakers. Only a few of the most salient points of the proceedings can be reported here.

The first thing one notes in reading this book is that there is no clear-cut organization of the subject matter. Theoretical plasma physics papers are thoroughly mixed with experimental results and reactor designs. If the reader wishes to read only those articles of specific interest to him, he must read the table of contents and hope that each author was quite explicit in his choice of a title.

Next, it is noted that most of the work is quite dated, having been completed usually by the summer or fall of 1972. A completely unreasonable time delay between the presentation of the results (November 1972) and the publication date (April 1974) has severely diminished the value of many of the papers. This is especially true for those papers describing research activities current in 1972. In fact, much of the work in this volume has been superseded by papers given at the First Topical Meeting on the Technology of Controlled Nuclear Fusion held in April 1974 and published in July 1974!

As for the makeup of the conference itself, one finds that 52% of the papers came from U.S. national laboratories, with Oak Ridge, a major facility in fusion research, conspicuously absent. Approximately 34% of the papers came from the academic community (60% of those came from the Universities of Texas and Wisconsin), 9% from private industry or laboratories, and only 5% from groups outside the United States.

The breakdown of the papers by categories is given below.

Theory and parameter studies	8
Neutronics	8
Energy storage	6
Reactor designs	6
Materials	5
Experimental results	5
Magnet design	4
Reactor coolants	4
Conceptual ideas	4
Fusion-fission	2
Tritium	2
General	2
Environment	1
Economics	1
	58

Let me try to highlight a few of the more notable contributions from the above list.

Conn et al. showed how sensitive self-consistent D-T plasma energy balance studies are to the limits placed on the poloidal beta. They also showed how one might control plasma operation by purposely injecting impurities to enhance the bremsstrahlung radiation. Hopkins reviewed how high atomic number impurity atoms can radiate energy from plasmas via recombination and line radiation at temperatures of $T \geq 10$ keV. He also established some empirical scaling factors to help in a quantitative analysis of these effects. Keller and Dolan pointed out that the traditional Lawson "break-even" values of $n\tau \approx 10^{14}$ sec cm^{-3} are considerably lower (by a factor of 10) than those characteristic of plasmas with normal density and temperature gradients.

The neutronics papers were quite diverse, ranging from a new way to reduce computation time for parametric studies by using variational methods, to a theoretical calculation of the neutron spectra emanating from the beam stop at LAMPF. Most of the reports treated the traditional topics of tritium breeding, transmutation reactions, and the proper order of S_x-P_y calculations required to obtain reasonable results.

There were several good papers reviewing alternate methods of energy storage, especially for the Theta-Pinch Reactors. Thomassen described a superconducting transfer and storage system that utilized three nested spherical coils and can

transfer 62% of the energy to and from the Theta-Pinch compression coils.

This was the first major conference where a complete set of self-consistent reactor designs was given. Tokamak designs were presented by PPPL and the University of Wisconsin, while LASL scientists discussed a Theta Pinch and a Laser system, and LLL workers described a complete mirror reactor concept. Both of the Tokamak studies utilized a magnetic diverter while the laser system contained a wetted lithium wall to protect the first structural wall. Detailed analysis of the direct conversion possibilities of a mirror reactor were also given.

Das and Kaminsky presented some data on the surface blistering of refractory metals during helium bombardment, concluding that the erosion rate by this phenomenon was one to two orders of magnitude greater than that due to charged particle sputtering.

Three separate papers described current plasma experiments at LASL, Fontenay-aux-Roses, and Frascati. While such papers were probably of interest to the members of the Conference, they have lost much of their value due to the long publication delay.

There were two papers analyzing the MHD pressure losses incurred when pumping lithium across magnetic field lines. Sze and Stewart showed that such pumping losses could be held to a few percent of the reactor output by clever arrangement of the flow patterns.

Owen and Impink explored a rather novel and original idea of how the ^3He atoms produced in a D-D reaction could be used in a CTR blanket to capture thermal neutrons and produce energy and more tritium atoms. The additional tritium atoms could then be fed back into the plasma to produce more energy by the D-T reaction.

Leonard and Wolkenhauer discussed their ideas on how a fusion-fission system could breed energy, tritium, and fissionable material, all at the same time. This study was purely neutronic in nature and did not address any of the long-term problems associated with fission products. However, they did point out that such a system would not be subject to a nuclear runaway because the k_{eff} was less than 1.

There were two excellent papers on tritium inventories and containment (Hickman and Hansborough). Both discussed the potentially high T_2 inventories which may be experienced if optimistic guesses at tritium extraction efficiencies are not realized.

It should be noted that this is one of the few conference proceedings which has been indexed.

The final question of whether such a book is desirable for one's personal bookshelf is yet to be answered. If the object of the purchaser is to obtain a current review of the state-of-the-art, then the answer is no. One can certainly obtain more recent proceedings in this field. If the purchaser wishes to have a complete bibliography for historical purposes, then this conference proceeding contains many interesting ideas and concepts that may stimulate future work in this field.

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