

Introduction to Plasma Physics and Controlled Fusion

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Introduction to Plasma Physics and Controlled Fusion

Third Edition



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Preface

It has been 30 years since the Second Edition. Plasma physics has grown so much that the temptation is to include all that's new, but I haven't done that. This is a book for those learning plasma physics for the first time and could care less about the fine points. The basics remain the same, but new areas have arisen: dusty plasmas and plasma accelerators, for instance, and these subjects had to be added. The semiconductor industry has sprouted since the 1980s, affecting all our lives. Computer chips cannot be made without plasmas, but these are partially ionized, radiofrequency ones, which are new. I've spent 25 years helping to make these industrial plasmas into an interesting subject, one that was previously avoided because it was too messy. Meanwhile, Al Gore has warned us about global warming. The best solution to this, and to energy shortage, is of course hydrogen fusion. With the ITER (International Thermonuclear Experimental Reactor) project going swimmingly in southern France, we are on schedule to get a fusion reactor by 2050. In laser fusion, the NIF (National Ignition Facility) at Livermore can focus the entire energy output of the United States onto a pinpoint for a fraction of a nanosecond to get inertial fusion. It is a technical achievement without peer, but so far we don't have a laser that can pulse rapidly enough. Fusion plasma physics was planned to be Vol. 2 of this textbook; and, in answer to so many questions, it is still in future plans. The job will be easier now that I have written *An Indispensable Truth, How Fusion Power Can Save the Planet*, which includes a chapter on fusion physics.

On the personal side, you will remember from the second edition that the "poet" (my father, who used to recite Chinese poetry from memory) had passed away, and that the "eternal scholar" (my mother) had finally gotten her Ph.D. at 72. She lived to 99 and died with a smile on her face. I myself am now 85, happily married for 49 years to artist Ande (Edna backwards), and we have two daughters and a son: Sheryl, a Cistercian nun in Norway; Patricia, a dancer and English teacher in France; and Bob, a chemical oceanography professor and education expert at UMass Boston, as well as an active soccer coach. We have four granddaughters,

the three Boston ones being third-generation soccer players, and the French one a four-language linguist and former equestrian.

Finally, I would like to thank all the instructors and students who have used the second edition and have pointed out errors and made suggestions for improvement.

Los Angeles, CA
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Francis F. Chen

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