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Particle simulation of plasmas, employed since the 1960s, provides a self-consistent, fully kinetic representation of general plasmas. Early incarnations looked for fundamental plasma effects in one-dimensional systems with ~10 2 –10 3 particles in periodic electrostatic systems on computers with 100 kB memory.

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Computer simulation of ELM crashes at the lower plasma edge of ASDEX Upgrade fusion device. The video shows the evolution of the plasma pressure over several ELM cycles during 35 milliseconds. Credit: Max Planck Institute for Plasma Physics / Andres Cathey, Matthias Hoelzl Trigger and course of ...

Realistic Simulation of Plasma Edge Instabilities in ...

"In our simulations we can actually see the MRI develop in experiments," said Himawan Winarto, a graduate student in the Princeton Program in Plasma Physics at PPPL and lead author of a paper in ...

Divided into three main parts, the book guides the reader to an understanding of the basic concepts in this fascinating field of research. Part 1 introduces you to the fundamental concepts of simulation. It examines one-dimensional electrostatic codes and electromagnetic codes, and describes the numerical methods and analysis. Part 2 explores the mathematics and physics behind the algorithms used in Part 1. In Part 3, the authors address some of the more complicated simulations in two and three dimensions. The book introduces projects to encourage practical work Readers can download plasma modeling and simulation software — the ES1 program — with implementations for PCs and Unix systems along with the original FORTRAN source code. Now available in paperback, Plasma Physics via Computer Simulation is an ideal complement to plasma physics courses and for self-study.

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Computer simulation is now widely recognized as a powerful tool and useful method at the current stage of research in space plasma physics. The expected role of computer simulation is to bridge the existing gap between theories and experiments/observations and to give a profound physical insight into highly tangled and nonlinearly coupled space plasma phenomena. One of the goals of space plasma physics in 1980's and 1990's is to elucidate the quantitative causal relationships of global and local energy flows in space plasma environment and establish the space plasma physics via cooperative studies among three important elements of observations, theories and computer simulations. Based on such recognition, Dr. M. Ashour-Abdalla (UCLA/USA), Dr. R. Gendrin (CNET/FRANCE) and both of us met together at the 20th General Assembly of URSI at Washington D. C. in 1981 to discuss what we should do and what we could do, reaching a conclusion that it is time to establish an International School of Space Simulations (ISSS). The objectives of the ISSS thus organized are firstly to educate and stimulate graduate students and young sCientists, secondly to exchange information on updated simulation techniques and thirdly to have mutual discussions among observational, theoretical and simulational scientists in the field of space physics. The first ISSS were organized by Prof. P. Coleman, Prof. T. Obayashi, Dr. H. Okuda in addition to the above four members. The first ISSS was held at Kansai Seminar House in Kyoto from Nov. I to Nov. 12, 1982.

Computer simulation of systems has become an important tool in scientific research and engineering design, including the simulation of systems through the motion of their constituent particles. Important examples of this are the motion of stars in galaxies, ions in hot gas plasmas, electrons in semiconductor devices, and atoms in solids and liquids. The behavior of the system is studied by programming into the computer a model of the system and then performing experiments with this model. New scientific insight is obtained by observing such computer experiments, often for controlled conditions that are not accessible in the laboratory. Computer Simulation using Particles deals with the simulation of systems by following the motion of their constituent particles. This book provides an introduction to simulation using particles based on the NGP, CIC, and P3M algorithms and the programming principles that assist with the preparations of large simulation programs based on the OLYMPUS methodology. It also includes case study examples in the fields of astrophysics, plasmas, semiconductors, and ionic solids as well as more detailed mathematical treatment of the models, such as their errors, dispersion, and optimization. This resource will help you understand how engineering design can be assisted by the ability to predict performance using the computer model before embarking on costly and time-consuming manufacture.

Assuming no prior knowledge of plasma physics or numerical methods, Computational Methods in Plasma Physics covers the computational mathematics and techniques needed to simulate magnetically confined plasmas in modern magnetic fusion experiments and future magnetic fusion reactors. Largely self-contained, the text presents the basic concepts neces

The physics of plasmas is an extremely rich and complex subject as the variety of topics addressed in this book demonstrates. This richness and complexity demands new and powerful techniques for investigating plasma physics. An outgrowth from his graduate course teaching, now with corrections, Tajima's text provides not only a lucid introduction to computational plasma physics, but also offers the reader many examples of the way numerical modeling, properly handled, can provide valuable physical understanding of the nonlinear aspects so often encountered in both laboratory and astrophysical plasmas. Included here are computational methods for modern nonlinear physics as applied to hydrodynamic turbulence, solitons, fast reconnection of magnetic fields, anomalous transports, dynamics of the sun, and more. The text contains examples of problems now solved using computational techniques including those concerning finite-size particles, spectral techniques, implicit differencing, gyrokinetic approaches, and particle simulation.

A wide-ranging introduction to the theoretical and experimental study of plasmas and their applications.