proposed advanced drivers are topics of consideration. The physics of pulsed power diode accelerators (i.e., the light-ion approach to fusion) is described in some detail. However, the physics of particle accelerators (i.e., the heavy-ion approach to fusion) is very brief. Target design, fabrication, and diagnostics are examined in Chap. 9. The section on general guidelines for target design is useful and informative. Examples of both laser and ion targets are illustrated. The sections on target fabricability and diagnostics could have been more informative. Chapter 10 is concerned with applications of ICF. The authors purposely concentrate on energy applications. A good overview of ICF reactors is given. The overview includes reactor cavity designs, blanket designs, beam optics, fusion-fission hybrids, and an overall laser fusion plant design.

The writing is clear and easy to read and tables and figures have been carefully selected to illustrate the points to be made. The authors have made a special effort to present simple analogies to help in the understanding of a concept. For example, in the introduction, a comparison is made between the inertial confinement reactor and the internal combustion engine. The extensive reference list at the end of each chapter is a useful tool for the person who wishes to pursue a subject in depth. The book contains more than 600 references.

In summary, this book is an exceptionally well-written, up-to-date, introductory text to ICF that is suitable for self-study or as a graduate text. The coverage may lack depth in some areas, but the breadth and variety of topics overcome this disadvantage so that the interested person could pursue specific areas of interest.

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Physics of Laser Driven Plasmas

Author	Heinrich Hora
Publisher	John Wiley & Sons, New York (1981)
Pages	317
Price	$36.95
Reviewer	Peter Hammerling

The subject of laser/plasma interaction, particularly within the context of laser fusion, is a very rich one. It starts with the basic interaction of the absorption, reflection, and refraction of the incident laser beam including the possible excitation of a host of plasma instabilities. The energy is then transported both radially and laterally outside the confines of the immediate deposition region. Radiation losses and their mechanisms of generation and transport also must be considered, as must the hydrodynamics of the ablation process, the hydrodynamic stability of the target and, for a spherical shell target, its subsequent motion toward the center. In principle, the interaction spans the non-collisional regime of the outer corona to, eventually, a nearly degenerate high-density plasma.

In view of the considerable effort expended in the study of the interaction between lasers and plasmas, a good monograph on this subject would be a welcome addition to the literature. This, unfortunately, is not such. Although Hora's work does cover many important aspects of laser/plasma interaction, it does so from a point of view original to the point of eccentricity, and contains a great deal to be disagreed with. The level of the work is never very clear, parts of it are elementary, parts of it are rather formidable. It appears to be aimed both at the newcomer to the subject who is interested in finding a coherent statement of the fundamentals as well as, in the last chapter, to the laser/plasma interaction community. The treatment of plasma dynamics is not very happy: There is an original interpretation of the role of plasmas with which few could agree. To a great extent he uses a simple hydrodynamic description, and even here, produces an energy equation that would raise some eyebrows!

The author does give a fairly complete treatment of the transmission and absorption of radiation in a spatially variable medium, although since it is confined to a one-dimensional spatial variation, this omits the entire subject of geometric optics. The longitudinal component of the field is also included at this level but resonant absorption is treated in a separate section.

Given the title, one might expect a fairly detailed treatment of anomalous absorption and scattering processes, but these are treated in a very perfunctory fashion. As might be expected, there is a fairly complete treatment of the origin of the ponderomotive force (although even here, some important references are not included), and its consequences in cavitation, filamentation, and so forth. In the last chapter, Hora suggests that the ponderomotive force from an extremely high-powered beam might tend to accelerate and compress a pellet to thermonuclear burn—clearly his central interest. This disagrees with the general opinion that at high-power levels the rapid forward heat transport by high-energy nonthermal electrons prevents adiabatic compression and disastrously raises energy thresholds. Indeed, perhaps because of this bias, the key topics of heat transport and hydrodynamic stability are not even mentioned.

This work cannot be recommended to those seeking an introduction to the field; however, representing as it does an extremely original view of the subject, it might be of interest to the cognoscente who may be prepared to put up with an idiosyncratic approach in the search for the occasional original insights.

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Plasma Astrophysics (Vols. I and II)

Author	D. B. Melrose
Publisher	Gordon & Breach Science Publishers, New York (1979)
Pages	724
Price	\$109.50
Reviewer	Donald B. Batchelor

Plasma Astrophysics, appropriately subtitled "Nonthermal Processes in Diffuse Magnetized Plasmas," is divided into two volumes titled "The Emission, Absorption, and Transfer of Waves in Plasmas (Vol. I)" and "Astrophysical Applications (Vol. II)."

The first volume is devoted to general theory and was obviously written as a textbook for graduate students in astrophysics and astronomy. It has all the trappings of a textbook, including problem sets at the end of each chapter, answers to many of the problems, and an appendix on Bessel functions. The second volume is an almost homogeneous mixture of basic theory, phenomenological discussion of radiation processes in astrophysics (cosmic rays, solar radio bursts, decametric radio emission from Jupiter, and the like), and an application of the theory to explain the observations. Together the books present a fairly thorough theoretical treatment of radiation processes in uniform plasmas. The coverage is very similar to that in Bekefi's *Radiation Processes in Plasmas*.[1] However, much more material is included and the approach is entirely different. Another reasonable comparison would be with the encyclopedic two-volume set *Plasma Electrodynamics* by Akhiezer et al.[2]

There is an introductory chapter that summarizes the radiation processes thought to be of importance in astrophysics and radio astronomy and that introduces the basic ideas of plasma physics: the Vlasov equation, Debye shielding, Langmuir waves, transverse electromagnetic waves, sound waves, and Alfven waves. There is also the usual discussion of characteristic plasma parameters, such as plasma frequency, collision frequency, and beta, with typical values given for plasmas of astrophysical interest.

The second chapter, titled "Waves in Plasmas," sets forth the formal properties of linear waves in a magnetized plasma. At the outset, Maxwell's equations are expressed in Fourier-transformed form with the plasma current described by a Fourier-transformed conductivity tensor, $j(\boldsymbol{k},w) = \boldsymbol{\sigma}(\boldsymbol{k},w)\cdot\boldsymbol{E}(\boldsymbol{k},w)$. Not including a convolution integral, of course, eliminates any effects of plasma inhomogeneity from consideration. However, there is no discussion of this restriction. The field of view is further restricted by considering only weakly damped (or growing) waves, i.e., waves for which the anti-Hermitian or dissipative part of the dielectric tensor $\boldsymbol{\epsilon}^A$ is small compared with the Hermitian or reactive part $\boldsymbol{\epsilon}^H$. It is not mentioned that $|\boldsymbol{\epsilon}^A| \ll |\boldsymbol{\epsilon}^H|$ is a sufficient but not a necessary condition for weak damping. Therefore, there are weakly damped waves for which the formal theory does not apply, such as ordinary mode waves near the fundamental cyclotron resonance. Within the context of weak damping, a detailed discussion is given of the general wave properties that are independent of the particular wave mode considered. These include symmetry properties of the dielectric tensor, transformation properties under reflection and time reversal, polarization vectors, the form for the wave energy, and relations between wave energy and group velocity. Finally, there are very brief discussions of the basic plasma wave modes. Waves in warm unmagnetized plasmas, Langmuir waves, and ion sound waves (including Landau damping) are discussed in two pages. Waves in cold magnetized plasmas are given four pages, and waves in warm magnetized plasmas are dispensed with in two pages.

Chapters 3 and 4 cover the theory of radiation due to single particle effects: Cerenkov emission, bremsstrahlung, Thompson scattering, synchrotron emission, and inverse Compton scattering. A unified treatment of all these phenomena is obtained by relating $u^\sigma(\boldsymbol{k})$, the energy radiated in mode σ with wave vector $\boldsymbol{k}$, to the time average of $\boldsymbol{J}^{ext}\cdot\boldsymbol{E}^\sigma$, where $\boldsymbol{J}^{ext}(\boldsymbol{k},w)$ is the Fourier transform of the current due to the moving particle and $\boldsymbol{E}^\sigma(\boldsymbol{k},w)$ is the electric field of mode σ induced in the plasma by the $\boldsymbol{J}^{ext}$. In each case, the calculation proceeds by solving for the particle orbit at the appropriate level of approximation, Fourier transforming the associated current, and then determining the plasma response from the wave equation with $\boldsymbol{J}^{ext}(\boldsymbol{k},w)$ as an inhomogeneous term. The discussion of Cerenkov radiation, bremsstrahlung, and Thompson scattering in Chap. 3 is somewhat less detailed than is available elsewhere (for example, in *Classical Electrodynamics*[3] by J. D. Jackson). There is, however, some mention of plasma effects, such as emission of Langmuir waves and bremsstrahlung from thermal plasmas.

The discussion of synchrotron emission in Chap. 4 begins with a derivation of general formulas for gyromagnetic radiation by particles of arbitrary energy in a plasma. Melrose uses the term "gyromagnetic emission" for radiation by particles due to the spiraling motion in a magnetic field, with the term "synchrotron emission" being reserved for radiation from ultrarelativistic particles, $\gamma \gg 1$. The presentation of synchrotron emission is very detailed including the frequency spectrum, polarization, emission at low frequencies, emission at small pitch angles, and many mathematical derivations. The chapter concludes with a section on inverse Compton scattering, i.e., the scattering of soft photons by hard (relativistic) electrons as opposed to the scattering of soft electrons by hard photons in Compton scattering. Several interesting exotic electron-photon processes are mentioned, such as scattering of Langmuir waves into transverse waves, nonlinear inverse Compton scattering, and nonlinear Thompson scattering. Unfortunately, neither the material on synchrotron radiation nor that on inverse Compton scattering is of much direct relevance for fusion applications since ultrarelativistic particles are not anticipated even in advanced fuel-fusion reactors.

Some nonlinear theory is also included. In Chap. 5 quasi-linear theory and the theory of nonlinear wave