



Aspects of Anomalous Transport in Plasmas (Series in Plasma Physics)

By Radu Balescu

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Anomalous transport is a ubiquitous phenomenon in astrophysical, geophysical and laboratory plasmas; and is a key topic in controlled nuclear fusion research. Despite its fundamental importance and ongoing research interest, a full understanding of anomalous transport in plasmas is still incomplete, due to the complexity of the nonlinear phenomena involved.

Aspects in Anomalous Transport in Plasmas is the first book to systematically consider anomalous plasma transport theory and provides a unification of the many theoretical models by emphasizing interrelations between seemingly different methodologies. It is not intended as a catalogue of the vast number of plasma instabilities leading to anomalous transport; instead it chooses a number of these and emphasizes the aspects specifically due to turbulence.

After a brief introduction, the microscopic theory of turbulence is discussed, including quasilinear theory and various aspects of renormalization methods, which leads to an understanding of resonance broadening, mode coupling, trajectory correlation and clumps. The second half of the book is devoted to stochastic transport, using methods based on the Langevin equations and on Random Walk theory. This treatment aims at going beyond the traditional limits of weak turbulence, by introducing the recently developed method of decorrelation trajectories, and its application to electrostatic turbulence, magnetic turbulence and zonal flow generation. The final chapter includes very recent work on the nonlocal transport phenomenon.

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