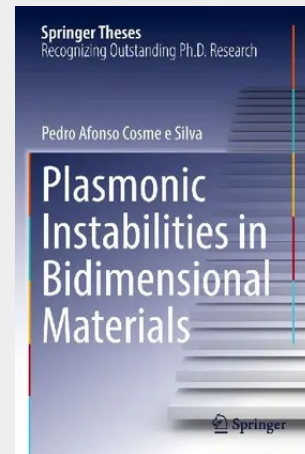


Plasmonic Instabilities in Bidimensional Materials

This book provides an in-depth analysis of the hydrodynamics of two-dimensional (2D) electronic systems, with a particular focus on graphene and other Dirac materials. It explores the theoretical framework and numerical simulations to uncover the potential of plasmonic instabilities in advancing nanotechnology. Moreover, the book also addresses the collective behaviour of quasiparticles in 2D materials and offers insights into the complex interplay between hydrodynamic behaviours and plasmonic phenomena. The main topics covered in this book include the hydrodynamic description of charge carriers, nonlinear waves, and topological effects in 2D electronic systems. It provides a comprehensive treatment of the Boltzmann equation to derive fluid-like transport equations, which are then used to study the collective responses and behaviours of these systems. The book also relies on the concept of electrostatic excitations, the plasmons, as an additional fluid and explores their effects and interplay with the charge carriers. One of the significant contributions of this book is the investigation of plasmonic instabilities and their potential applications in creating new active nanodevices, such as THz radiation sources. The theoretical findings are supported by extensive numerical simulations, providing a deeper understanding of the principles governing electronic flow in 2D materials. Further, this work also examines the nonlinear dynamics of electrohydrodynamics, revealing phenomena such as solitary waves, and the criteria for their occurrence. Lastly, the novel aspects of topological effects on the charge flow are also investigated. The importance of this work lies in its dual contribution to fundamental research and practical applications. On the theoretical side, it advances our understanding of the hydrodynamic regime of 2D materials and the transient and dynamic responses of these systems. On the practical side, it proposes novel device implementations, such as plasmonics oscillators and waveguides. On that topic, the book addresses the challenges of these devices, offering solutions to enhance controllability and to boost performance as well. This book is essential for graduate students, researchers, and professionals in the fields of quantum plasmas, 2D materials, and plasmonics. It is particularly valuable for plasma scientists interested in exploring 2D materials and condensed matter physicists who wish to study the hydrodynamic regime and the dynamic responses of these systems. By providing a detailed and comprehensive understanding of these advanced topics, this book paves the way for future research and technological innovations in the rapidly evolving fields of electrohydrodynamics and plasmonics.

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