

Preface

In this book, we develop basic and advanced concepts of plasma thermodynamics from both classical and statistical points of view. After a refreshment of classical thermodynamics applied to the dissociation and ionization regimes, the book introduces the reader, since the very beginning, to discover the role of electronic excitation in affecting the properties of plasmas, a topic often overlooked by the thermal (equilibrium) plasma community. This point is usually disregarded in the existing textbooks of statistical mechanics and thermodynamics mainly devoted to temperature ranges much lower than those covered in this book.

Concepts, such as translational and internal partition functions of atomic and molecular species, are introduced and discussed with different degrees of accuracy. Particular attention is paid to the problem of the divergence of partition function of atomic species as well as to the *state-to-state* approach for calculating the partition function of diatomic and polyatomic molecules, going beyond the well-known harmonic oscillator and rigid rotor approximations. The limit of the ideal gas approximation is then discussed by presenting non-ideal effects including Debye-Hückel and virial corrections. Plasma properties for one and multi-temperature situations are then discussed presenting in the last chapter tables of thermodynamic properties of high temperature planetary atmosphere (Earth, Mars, Jupiter) plasmas.

The book is intended as a graduate-level textbook as well as a monograph on high temperature statistical thermodynamics useful for thermal plasma researchers. The first four chapters are being used for undergraduate students of Physics and Chemistry of the University of Bari (Italy).

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Thermodynamics

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