

CONTENTS

LECTURE I AIM AND STRUCTURE OF SPECTROSCOPIC DIAGNOSTICS

Fundamental problems of spectroscopic diagnostics;
Intuitive approach to the state of a gas—observational vs. complete states;
A priori approach to the complete state of a gas.

LECTURE II EMPIRICAL METHODOLOGY FOR SPECIFYING THE OBSERVATIONAL STATE

The intermediate set of parameters—source-function and optical-depth;
Empirical determination of the intermediate set from a priori assumption on their ν -dependence;
Consideration of the effect of velocity fields upon the determination of intermediate parameters.

LECTURE III THEORETICAL APPROACH TO THE INTERMEDIATE PARAMETERS

Microscopic parameters specifying the intermediate parameters—occupation numbers and profile coefficients—and the rate-process approach to their determination;
Algebraic expression for S_ν and consideration of the physical quantities upon which it depends;
Local and nonlocal control of the source-function via the radiation and velocity fields, the locally-opaque and thin situations.

LECTURE IV THE SMALL-PERTURBATION VS. THE GENERAL RATE-PROCESS APPROACH TO THE NON-LTE CONFIGURATION FOR A DIFFUSE RADIATING GAS

Review of the TE and LTE configurations from the LOS and LOS- Σ concepts—homogeneity, detailed-balance, no flux;
Modification of the LTE configuration by relaxation of the LOS- Σ requirement—the small-perturbation approach to non-LTE and its difficulty for a diffuse, high-temperature ensemble;

Influence of the spectral lines on the distribution of T_e in a stellar atmosphere.

LECTURE V THE RADIATIVE TRANSFER PROBLEM FOR ATMOSPHERIC SELF-EMISSION

Recapitulation of the self-consistency problem on the radiation field;

An ensemble homogeneous in source and sink terms—the influence of the boundary in introducing departure from $LOS-\Sigma$ in a semi-infinite atmosphere;

Comparison of semi-infinite and finite atmospheres homogeneous in source and sink terms;

Consideration of the nonhomogeneous semi-infinite ensemble and the effect of the scale of nonhomogeneity;

Consideration of the nonhomogeneous finite ensemble and the homogenizing effect of the radiation field.

LECTURE VI RELATION OF THE LOCAL ENERGY CONTENT OF THE GAS TO ITS SPECTROSCOPIC STATE

General considerations on the interrelation between local energy content of the gas and the local spectroscopic state;

Consideration of the coupling mechanism between radiation field and translational degrees of freedom of the gas—addition of the continuum to the radiation transfer problem;

Consideration of the interrelation between general radiation field, electron temperature, and spectroscopic state of the gas.

LECTURE VII THE NEW SPECTROSCOPY

Comparison of the classical laboratory spectroscopy of a dense, optically-thin gas with that of a diffuse gas—definition of the New Spectroscopy;

Dependence of the local spectroscopic state of a 2-level-atom gas upon ionic and atmospheric models—first approximation to categories for the New Spectroscopy;

Consideration of departures from the 2-level-atom representation to establish more general categories for the New Spectroscopy.