

Instruction Guide For Physicists

A one-semester course for physics students on **Atomic Astrophysics**, consisting of 40 one-hour lectures, may be designed as an introduction to astronomy. The order is somewhat the reverse of that outlined in the Instruction Guide for Astrophysicists.

First, it is helpful to familiarise oneself with basic astronomy and nature of astrophysical objects. The knowledge of physical processes so gained can direct the readers to spectral formation. The theoretical or experimental framework required to analyze astrophysical spectra can then be established.

Physics students and researchers would be interested in the fundamental processes in astronomy, but probably not inclined to delve into the details of astronomical technology, or relatively advanced topics such as the discussion of the often bewildering variety of interpretations for the *same* phenomenon. Therefore, we have attempted to eschew those aspects of astronomical research in the textbook.

An important caveat is that the discussion of astronomical objects is necessarily concise. However, the introductory subject matter is relatively simple. **We plan to post additional reading material on selected topics on our website under the category "Popular Articles"**. Also there are many introductory astronomy textbooks, and of course the Internet for basic description of astronomical objects (albeit generally unrelated to spectroscopy).

For physics students we recommend the following sequence of topics.

Ch.1 **Introduction** — All sections

Ch.2 **Atomic Structure** — Introductory sections

Ch. 3 **Atomic Processes** — Partial selections

Ch. 10. **Stellar properties and spectra** — All sections

Ch. 11. **Opacity and Radiative Forces**

11.1 Radiative and convective envelope

11.2 Equations of stellar structure

Ch. 12 **Gaseous nebulae and H II regions**

12.1 Diffuse and planetary nebulae

12.2 physical model and atomic species

12.3 Ionization structure

12.4 Spectral diagnostics

Ch. 13 **Active galactic nuclei and quasars**

13.1 Morphology, energetics and spectra

13.2 Spectral characteristics

13.3 Narrow-line region

13.4 Broad-line region

13.6 The central engine - X-ray spectroscopy (partial)

Ch. 14 **Cosmology** — All sections

Selected sections from the following chapters on atomic physics, (roughly as in the Instruction Guide for Astrophysicists).

Ch. 4 **Radiative transitions**

Ch. 5 **Electron-ion collisions**

Ch. 6 **Photoionization**

Ch. 7 **Electron-ion recombination**

A discussion of emission and absorption line formation should then follow, with partial selections from

Ch. 8. **Multi-wavelength emission spectra**

Ch. 9. **Absorption lines and radiative transfer**