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 familiarize 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