Astronomy 871: Physics of the Interstellar Medium
Spring Quarter 2003
Bibliography & Supplemental Reading

Textbooks:

Osterbrock, D.E. 1989, *The Astrophysics of Gaseous Nebulae & Active Galactic Nuclei*, (Mill Valley:University Science Books). I'll usually refer to this book as Osterbrock or AGN², rather than by its full title. It is one of the classics in the field covering primarily gaseous nebulae (aka gasbags) with little on traditional ISM (absorption lines, etc) or modern IR and mm-wave observations. It covers all of the necessary physics of ionized nebulae, and the second edition now includes chapters on the application of nebular physics to active galaxies. Beware, there are still typos in this book, but not nearly as many as in the first edition.

Dopita, M.A. & Sutherland, R.S. 2003, *Astrophysics of the Diffuse Universe*, (Berlin: Springer-Verlag A&A Library). A new addition to the genre, much more general in scope than Osterbrock, more up-to-date than Spitzer (see below), but also more detailed than either. Too detailed, in fact, for an introductory course like this, but definitely a book you will want on your shelf if you are at all interested in the field. Includes a discussion of atomic and molecular energy levels (read: quantum), a bit more recent stuff on shocked gas, and an interesting chapter on Astrochemistry.

Spitzer, L. 1978, *Physical Processes in the Interstellar Medium*, (New York:Wiley). A classic text recently reprinted in paperback by Wiley. It covers more traditional ISM, especially absorption lines, dust, grain physics, etc. Some of the observational source material is a little dated because of recent advances in IR and mm-wave technology, but the physics is very sound. It is organized by physical processes, rather than by the traditional division of topics in ISM, so you often find yourself hopping around through it. A caveat: Spitzer’s notation is somewhat idiosyncratic in places, so that you often have to translate between this and what is more commonly encountered in the literature. Regardless, It is an excellent companion to Osterbrock’s book, filling in many gaps. We’ll refer to Spitzer repeatedly through the course. It deserves a place in your library if you can afford it.

Compendia & Conference Proceedings:

Hollenbach, D.J., & Thronson, H.A. 1986, *Interstellar Processes*, (Dordrecht:Reidel). Proceedings of the First Wyoming Conference in July 1986. This is one of those very rare conference proceedings that have proven to have long-lasting value. It is loaded with great review articles of relevance to modern ISM studies, and a good follow-on to the older astronomy in Spitzer or the just the basics approach of Osterbrock. It is not suitable as a text as it goes well beyond the basic level of the class and more into specifics. Excellent reviews of relevance are by Shull, Kulkarni & Heiles, Savage, Jenkins, Herbst, and others. If you decide to get serious about ISM as your research field, the paperback edition is under $40 and worth every penny (but out of print). I’ll occasionally refer you to articles in IP for detailed discussions of those topics that have undergone substantial revision since Spitzer.

**Other Reading:**

These are sources you might wish to consult if you have an interest in going beyond the basics covered in the course. This is not required reading, but is the list of sources I consulted when putting my lectures together.

Thronson, H.A., & Shull, J.M. 1989, *The Interstellar Medium in Galaxies*, (Kluwer). Invited talks from the Second Wyoming Conference in July 1989. Extends the topic of the ISM to other galaxies. Particularly fine review articles you should read are by Knapp, Dinerstein, Cox, Brinks, and Kennicutt. Overall, though, it is not quite all up to the standards of the first book (IP). Some articles will need to be taken with a grain of salt (or dust) as well.

Cowie, L.L., & Songaila, A. 1986, ARA&A, 24, 499. *High-Resolution Optical and UV Absorption Line Studies of Interstellar Gas*. A good review of the observations and applications of interstellar absorption lines to studying the properties of the ISM. Based primarily on Copernicus and IUE observations.

Savage, B.D., & Sembach, K.R. 1996, ARA&A, 34, 279. *Interstellar Abundances from Absorption-line Observations with the Hubble Space Telescope*. An excellent recent review of the precision abundance work that was done (up to 1995) with the Goddard High-Resolution Spectrograph on HST. Goes well beyond the work done by the Copernicus satellite (although HST cannot sample the Far-UV where HI Lyman series and H2 lines reside, so it does not completely supplant that work).

Cox, D.L., & Reynolds, R.J. 1987, ARA&A, 25, 303. *The Local Interstellar Medium*. A recent review of the properties of the ISM within about 100pc of us (the Local Superbubble). Some recent EUVE work has changed the details some, but little of that has been published to date.


Peimbert, M., & Torres-Peimbert, S. 1977, MNRAS, 179, 217. The first detailed study of the abundances in the Orion Nebula, and a work which introduced many of the basic tools employed by subsequent studies of galactic and extragalactic abundances using the spectra of HII regions.

Draine, & Lee 1984, ApJ, 285, 89. Like MRN before it (see next), this paper sets the standard for papers on the properties of dust grains. If a deeper understanding of the physics of dust grains is needed, you’re on the frontiers and probably on your own. A challenging tightly-packed paper.
Mathis, Rumpl, & Nordsieck, 1977, ApJ, 217, 425. A classic paper on the properties of dust. It lays down much of the framework within which subsequent work on dust is based, and describes the MRN Mixture of dust grains that one commonly encounters in the literature. It has been largely (but not completely) superceded by Draine & Lee 1984.

Savage, & Mathis, 1979, ARA&A, 17, 73. Classic review article on interstellar extinction. The Savage & Mathis extinction curve is cited repeatedly in the current literature by anyone who has to cope with galactic or extragalactic extinction (which is nearly every optical astronomer). Although it has recently been supplanted by the Clayton, Cardelli, & Mathis curve, primarily cited from…


Spitzer, L. 1990, ARA&A, 28, 71. *Theories of the Hot ISM*. Good recent review describing the third phase of modern ISM models in terms of the emerging theoretical problems of describing the very hot components of the ISM.

Hollenbach, D.J., & Tielens, A.G.G.M. 1997, ARA&A, 35, 179. *Dense Photodissociation Regions (PDRs)*. An excellent general review of the astrophysics of PDRs by two of the undisputed masters of the topic. Also a good point of entry into the recent literature on PDRs (see also the PDR chapter in Dopita & Sutherland’s book).

Astronomy & Astrophysics, 1996, 315. The *Letters* section of this volume of A&A is devoted to the first science results from the ISO satellite. This is so far the largest compendium of ISO results, many preliminary that have appeared in print. (ISO calibration issues are proving very difficult, so results have been dribbling out slowly). A 2-volume set of proceedings from Europe is reputed to be circulating but I can’t locate it.