AS 751 – GALACITC ASTRONOMY
AND THE INTERSTELLAR MEDIUM
Fall 1995

Course Catalog Summary:

Prereq: GRS AS 711, 712, or consent of instructor. Physical processes in interstellar gas. Gaseous nebulae. Star formation. Neutral hydrogen and galactic structure. Molecular clouds, ionized hydrogen regions, planetary nebulae, supernova remnants. Dust and extinction. Cosmic rays and the galactic magnetic field.

Instructor:

Prof. Dan Clemens

Lecture Times:

Tuesdays and Thursdays 2:00 pm to 3:30 pm in CAS 500

Required Texts:

1.) "*Physics of the Galaxy and Interstellar Matter,*" by Scheffler & Elsässer (BU Bookstore)
2.) "*Astrophysics of Gaseous Nebulae and Active Galactic Nuclei,*" by Osterbrock (BU Bookstore)

Recommended Texts:

1.) "*Galactic Astronomy,*" by Mihalas and Binney (BU Bookstore)
2.) "*Physical Processes in the Interstellar Medium,*" by Spitzer (BU Bookstore)
3.) "*The Milky Way as a Galaxy,*" by Gilmore, King, & van der Kruit (BU Bookstore)

Grading:

The course grade will be computed by weighting you performance in the following areas by the percentages listed:

Homework [3 total]	30%
Computational Projects	30%
Writing Assignments [2 total]	30%
Participation and Attendance	10%

Synopsis of Course:

This course is taught at the advanced graduate level and is intended to form a bridge from general courses in astrophysics (AS 701/711/712) to dissertation research in the areas of galactic structure, galactic dynamics, star formation, molecular or atomic cloud astrophysics, and dense cloud core astrophysics. We will use many of the classic texts in these fields to develop a solid foundation in the areas of the astrophysics of the interstellar gas and dust, and structure and kinematics of the galaxy. Much of the emphasis of the course will be on developing critical reading and writing skills, and polishing those skills to the level necessary for writing research papers in these fields.

Homework:

There will be a total of three homework assignments intended to lead students to develop the necessary analytical tools for solving problems in the complex areas of galactic rotation, galactic metallicity evolution, and the time dependent structure of ionization spheres.

Computational Projects:

There will be three modestly large computational projects. These will require use of a computer and proficiency in a programming language.

Writing Assignments:

Clear, effective writing is required of researchers in all fields. In order to enhance the writing and reading skills of students enrolled in this course, there will be frequent reading assignments (research journal articles) with two major writing assignments.

Exams:

There are no exams scheduled for this course. (Watch out – that increases the importance of turning in ALL assignments.)

Schedule:

Lecture 1:

Course introduction. Milky Way Galaxy I: Components. Stars, Gas, Dust, Dark Matter.

Lecture 2:

Milky Way Galaxy II: Stellar Systems,

Lecture 3:

Milky Way Galaxy III: Stellar Motions.

Lecture 4:

Milky Way Galaxy IV: Stellar Motions.

Lecture 5:

Milky Way Galaxy V: Galactic Rotation.

Lecture 6:

Milky Way Galaxy VI: Gas Distributions and Motions.

Lecture 7:

Interstellar Gas I: Thermal Balance.

Lecture 8:

Interstellar Gas II: Photoionization and Recombination, Heating and Cooling mechanisms.

Lecture 9:

Interstellar Gas III: Two-Phase ISM.

Lecture 10:

Interstellar Gas IV: Ionized Hydrogen Regions. Neutral Hydrogen Clouds.

Lecture 11:

Interstellar Gas V: Molecular Clouds, Planetary Nebulae and Supernovae Remnants.

Lecture 12:

Interstellar Dust I: Physical Properties of Dust Grains.

Lecture 13:

Interstellar Dust II: Extinction and Reddening.

Lecture 14:

Interstellar Dust III: Heating and Cooling, Energy Budgets for Molecular Clouds.

Lecture 15:

Interstellar Dust IV: Infrared Excesses. Color-Color Diagrams.

Lecture 16:

Interstellar Dust V: Polarization of Starlight (Absorption).

Lecture 17:

Interstellar Dust VI: Polarization of Dust Thermal Emission.

Lecture 18:

Star Formation I: Collapse and Fragmentation.

Lecture 19:
Star Formation II: Dense Cloud Cores.
Lecture 20:
Star Formation III: Protostars.
Lecture 21:
Star Formation IV: Young Stellar Objects, T Tauri Stars.
Lecture 22:
Star Formation V: Outflows, Stellar Winds, Shocks HH Objects.
Lecture 23:
Cosmic Rays and Magnetic Fields I: Properties of Cosmic Rays.
Lecture 24:
Cosmic Rays and Magnetic Fields II: Magnetic Fields of Other Galaxies.
Lecture 25:
Cosmic Rays and Magnetic Fields III: Magnetic Fields of the Milky Way.
Lecture 26:
Galactic Center I: Distribution of Matter and Radiation.
Lecture 27:
Galactic Center II: Kinematics and Evolution.

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