

PROPOSAL TO THE SENATE COMMITTEE ON EDUCATIONAL POLICY
Proposal for a Graduate Concentration in Astrochemistry

TITLE OF PROPOSAL: Astrochemistry

SPONSORING DEPARTMENTS: Chemistry and Astronomy

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BRIEF DESCRIPTION:

Astrochemistry is an interdisciplinary area of knowledge at the intersection between chemistry and astronomy. As a few examples, topics of active research in this area include identifying organic molecules in interstellar space, building models of the chemical reactions that occur in interstellar space, laboratory measurements of astronomically important molecules, searching for Earthlike planets using molecular signatures, and understanding the contributions of interstellar molecules to the chemical origin of life. In order to succeed in this field, students require training in both of the traditional disciplines of chemistry and astronomy. The proposed graduate concentration in astrochemistry will provide a framework for such training for Ph.D. students.

Students concentrating in astrochemistry would be required to complete a minimum of 24 graduate hours of formal coursework (excluding research credit) at the 400- and 500-level. A steering committee consisting of faculty from both departments would be appointed (by the Head of Chemistry and the Chair of Astronomy) to oversee the concentration, and to make any necessary modifications to the course requirements as offerings change over time. Students would be required to complete at least 12 hours of Chemistry courses, as well as at least 12 hours of Astronomy courses; as part of this requirement, students must complete CHEM/ASTR 450, Astrochemistry. A list of recommended courses is given in Appendix A, but students may substitute other courses with consent of the steering committee. The courses taken to fulfill the requirements of this concentration could also be used to satisfy departmental requirements, as described in Appendix B. Students concentrating in astrochemistry would be expected to have at least one member of each department on their thesis committee.

The expected enrollment in this concentration is approximately three to four students per year, or about 15-20 students at any given time.

JUSTIFICATION:

Transcript recognition is important to students in this interdisciplinary area, to ensure that they will be recognized as qualified by scientists in both traditional fields (chemistry and astronomy). The formalization of an Astrochemistry concentration will also have benefits to UIUC. It is expected to enhance communication between the two departments, and will likely result in the formation of new research collaborations. Furthermore, it would position UIUC as a national leader in this emerging discipline, as the first university to offer such a program. Finally, it will assist both departments in recruiting highly qualified graduate students to their programs.

BUDGETARY AND STAFF IMPLICATIONS:

The budgetary and staff implications of creating this concentration are expected to be minor. A steering committee would be formed, which would require perhaps an hour or two of each member's time per year. Students would remain primarily "chemistry" or "astronomy" students, so no additional administrative burdens are expected, as the students would continue to be handled (from admissions to graduation) by staff in their respective departments. The other courses listed in Appendix A are already offered on a regular basis.

CLEARANCES:

Professor Gregory S. Girolami
Head, Department of Chemistry

Professor Lewis E. Snyder
Chair, Department of Astronomy

Professor Thomas B. Rauchfuss
Director, School of Chemical Sciences

Professor
Dean, College of Liberal Arts and Sciences

Professor
Dean, Graduate College

STATEMENT FOR THE PROGRAMS OF STUDY:

The graduate concentration in astrochemistry is intended for Ph.D. students in chemistry or astronomy who wish to gain the necessary background to perform original research in the interdisciplinary field of astrochemistry. For this concentration, at least 24 hours of graduate level coursework (at the 400- and 500- level) are required, of which at least 12 must be in chemistry courses and at least 12 in astronomy courses. All students in the concentration are required to take CHEM/ASTR 450, Astrochemistry, which may count toward either the astronomy or chemistry requirements. Students concentrating in astrochemistry should have at least one member from each department on their thesis committee.

EFFECTIVE DATE: August 1, 2005 (pending approval)

APPENDIX A: Recommended Courses

All students are required to take ASTR/ CHEM 450, which can be counted as either a Chemistry or an Astronomy course, depending on each student's preference. Courses listed with an (*) below are strongly recommended for astrochemistry concentrators.

ASTR 404 – Stellar Astrophysics

*ASTR 405 – Solar System / Interstellar Medium

ASTR 406 – Galaxies & The Universe

ASTR 502 – Theory of Diffuse Matter Dynamics

*ASTR 503 – Observational Astronomy

ASTR 504 – Theoretical Stellar Physics

ASTR 596 – Special Topics in Astronomy (when appropriate)

CHEM 522 – Experimental Spectroscopy

CHEM 532 – Advanced Organic Chemistry: Reaction Mechanisms (Physical Organic)

*CHEM 540 – Quantum Mechanics

CHEM 542 – Quantum Mechanics and Spectroscopy

CHEM 544 – Statistical Thermodynamics

CHEM 548 – Molecular Electronic Structure

CHEM 550 – Quantum Dynamics

CHEM 552 – Chemical Kinetics

CHEM 554 – Topics in Physical Chemistry (when appropriate)

APPENDIX B: Relationship between Departmental and Concentration Course Requirements

Chemistry Ph.D. students choose an “area” of specialization (e.g. physical chemistry or organic chemistry), and are required to complete at least 8 hours of graduate coursework within their area, and at least 8 hours outside their area, and at least 20 hours in total. Physical chemists concentrating in astrochemistry could count 8 hours of physical chemistry courses (e.g. CHEM 540 and CHEM 542) towards their “in area” requirement, and could count all 12 hours of astronomy courses (e.g. ASTR 405, ASTR 503, and ASTR 450) as their “out of area” requirement. Concentrating in astrochemistry would then only require physical chemists to take four “extra” hours of coursework above the chemistry requirement. Chemistry students in other areas (e.g. organic or analytical) might need to take eight “extra” hours of coursework to concentrate in astrochemistry, unless they can identify other courses in their area which the steering committee considers relevant to astrochemistry.

Astronomy Ph.D. students are required to complete ASTR 502, 503, 504, and 590, as well as at least 32 additional hours of graduate coursework. The twelve hours of astronomy coursework required by the astrochemistry concentration would also count towards the astronomy requirements. Astronomy students would then only need to complete twelve hours of chemistry courses (including ASTR/CHEM 450) to satisfy the concentration requirements. Upon approval of this concentration, the astronomy requirements will be modified so that the twelve hours of chemistry courses undertaken as part of the astrochemistry concentration could also be counted towards the astronomy course requirements (pending approval of the Astronomy Curriculum Committee).