

: ASTROPHYSICS, BSLAS

In Workflow

1. U Program Review (dforgacs@illinois.edu; eastuby@illinois.edu; aledward@illinois.edu)
2. 1430 Head (lwl@illinois.edu; bdunne@illinois.edu)
3. KV Dean (las-catalog@illinois.edu)
4. University Librarian (jpwilkin@illinois.edu)
5. Provost (kmartens@illinois.edu)
6. Senate EPC (bjlehman@illinois.edu; moorhouz@illinois.edu; kmartens@illinois.edu)
7. Senate (jtempel@illinois.edu)
8. U Senate Conf (none)
9. Board of Trustees (none)
10. IBHE (none)
11. DMI (eastuby@illinois.edu; aledward@illinois.edu; dforgacs@illinois.edu)

Approval Path

1. Thu, 18 Mar 2021 19:51:56 GMT
Deb Forgacs (dforgacs): Approved for U Program Review
2. Thu, 18 Mar 2021 22:46:29 GMT
Leslie Looney (lwl): Approved for 1430 Head
3. Wed, 24 Mar 2021 15:16:52 GMT
Kelly Ritter (ritterk): Approved for KV Dean
4. Wed, 24 Mar 2021 15:48:12 GMT
John Wilkin (jpwilkin): Approved for University Librarian
5. Mon, 05 Apr 2021 13:20:34 GMT
Kathy Martensen (kmartens): Approved for Provost

New Proposal

Date Submitted: Thu, 18 Mar 2021 19:43:34 GMT

Viewing:: Astrophysics, BSLAS

Changes proposed by: Amy Elli

Proposal Type

Proposal Type:

Major (ex. Special Education)

Proposal Title:

If this proposal is one piece of a multi-element change please include the other impacted programs here. *example: A BS revision with multiple concentration revisions*

Establish Bachelor of Science in Liberal Arts & Sciences in Astrophysics in the Department of Astronomy within the College of Liberal Arts & Sciences

EP Control Number

EP.21.114

Official Program Name

Astrophysics, BSLAS

Effective Catalog Term

Fall 2022

Sponsor College

Liberal Arts & Sciences

Sponsor Department

Astronomy

Sponsor Name

Leslie Looney, Chair, Department of Astronomy

Sponsor Email

lwl@illinois.edu

College Contact

Kelly Ritter

College Contact Email

ritterk@illinois.edu

Program Description and Justification

Provide *abrief* description and justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

This proposal seeks to establish a new BSLAS Astrophysics major in the Department of Astronomy (LAS) in addition to the existing BSLAS Astronomy major. No change is proposed to the existing Astronomy major.

A new Astrophysics major is being proposed that will provide Astronomy majors with a pathway to achieve a full astrophysics experience. (Modern astronomy is astrophysics.) The Department of Astronomy has two main populations of majors: 1) students who only want the minimum required number of physics courses, expecting to use their interdisciplinary skills in industry, and 2) students who want more physics courses to be rigorously prepared for graduate school or other more technical professions. To date, the latter group have typically achieved this preparation by double major or dual degree in LAS Physics.

With the proposed consolidation of several Physics degrees into a single program within the Grainger College of Engineering (GCOE), the existing LAS Physics degree program will be phased out. As a result of this change, students will not be able to double major in Physics and Astronomy. Instead, students would have to pursue a dual degree, which requires an additional 30 credit hours and satisfying the requirements of both the college of Liberal Arts and Sciences (LAS) and the GCOE. In addition, entry to the GCOE is only possible upon matriculation to the University or via application to the PREP program before the end of freshman year. Furthermore, a physics minor alone does not give our Astronomy majors enough flexibility necessary to prepare them fully for astrophysics graduate school, especially graduate programs in joint Astronomy/Physics Departments. Over the last 5 years, the competition for graduate school has dramatically increased. (For example, at Illinois we accepted ~7% of astronomy graduate applicants for AY20-21.) Our goal, with the creation of a new Astrophysics major in the Department of Astronomy, is to provide an unsurpassed rigorous preparation for our best students. Leveraging two great Departments, Astronomy and Physics, on campus, this new major will provide students with one of the most flexible astronomy and astrophysics options for students in the country.

Corresponding Degree

BALAS Bachelor of Arts in Liberal Arts and Sciences

Is this program interdisciplinary?

No

Academic Level

Undergraduate

Will you admit to the concentration directly?

No

Is a concentration required for graduation?

No

CIP Code

40.0202 - 40.0202

Is This a Teacher Certification Program?

No

Will specialized accreditation be sought for this program?

No

Institutional Context

University of Illinois at Urbana-Champaign

Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built.

Explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

The historical context of this new program arises fundamentally from the fact that the Department of Physics resides within the Grainger College of Engineering while other physical sciences, such as Chemistry, Mathematics, Statistics, Atmospheric Sciences, Geology, Chemistry, and Astronomy, among others, reside within the College of LAS; the Physics degree programs have been split between colleges. While the Department of Physics is within the GCOE, there have been three Physics degree programs administered by LAS. These LAS degree programs have provided opportunities for students to explore Physics and Astronomy together through double majors, but also caused some confusion and variations in services. The Physics Department is advancing a proposal to consolidate all Physics degree programs into the GCOE to better serve Physics students at Illinois.

The new Astrophysics major is an adaptation to this change that best allows us to serve the mission of the University of Illinois and best prepare our students. The new major will build on the existing Astronomy major and on the existing courses offered by the Department of Physics. The proposal for an Astrophysics major in Astronomy has been extensively discussed with Physics as part of their broader changes and has their approval as an academic accommodation to these developments. By mutual agreement the students in the Astrophysics major will have access to the courses included in our proposed curriculum. In addition, to best prepare our astrophysics students, we will be enhancing our astrophysical laboratory course (ASTR 414, Astronomical Techniques).

University of Illinois

Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

The goal of this new major is to maintain excellence in the education of students in astronomy and astrophysics. Due to the close academic relationship between the disciplines of physics and astronomy, this new Astrophysics degree contains a rich preparation in foundational Physics so that students are prepared for future advanced study in astronomy (which is really astrophysics) and for advanced technical employment. We have built into our program a unique flexibility that allows students to choose which courses best match their goals and to provide a title (astrophysics) that is more in line with the rigor of the required courses.

State of Illinois

Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)

Educational Attainment - increase educational attainment to match the best-performing states.

High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.

Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

Describe how the proposed program supports these goals.

This program will meet the enumerated goals of the Illinois Board of Higher Education's (IBHE) Strategic Initiative. The program meets the goal of Educational Attainment by sustaining an option for students to graduate with a rigorous preparation in Astrophysics, as required for many graduate schools, and in order to match commensurate academic offerings in peer institutions in other states. The program addresses College Affordability by retaining the tuition schedule in place for the existing Astronomy major. The new major prepares students for advanced study or technical careers and therefore helps to provide High Quality Credentials to Meet Economic Demand. This new major integrates and efficiently deploys campus strengths in two disciplines and therefore provides closer Integration of Educational, Research and Innovation Assets.

Admission Requirements

Desired Effective Admissions Term

Fall 2022

Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

The admissions requirements are the standard for campus at the undergraduate level.

Describe how critical academic functions such as admissions and student advising are managed.

Admissions are handled through campus. The astronomy advisor will be used for student advising, which has capacity. Students meet with the advisor every semester where classes, plans, and professional development are discussed.

Enrollment

Number of Students in Program (estimate)

Year One Estimate

12

5th Year Estimate (or when fully implemented)

50

Estimated Annual Number of Degrees Awarded

Year One Estimate

0

5th Year Estimate (or when fully implemented)

13

What is the matriculation term for this program?

Fall

What is the typical time to completion of this program?

4 years

What are the minimum Total Credit Hours required for this program?

120

Delivery Method

This program is available:

On Campus

Budget

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

Yes

Please explain/describe:

This is a new major with rigorous requirements in physics and astrophysics that will provide our students essential training for graduate school or other technical professions. We have taken care to craft this new major from existing courses in Astronomy and Physics. A student in the new major will need experience working with real data in an experimental or laboratory setting including data acquisition, analysis, and statistical and scientific interpretation. Although, this requirement can be fulfilled by physics courses, it is also important to allow students to have direct access to modern astrophysics observations. As such we propose to strengthen the laboratory component of ASTR 414 (Astronomical Techniques) to include a richer experience with astronomical data acquired during the semester. The Department of Astronomy is working with LAS to identify funding opportunities to expand this course. If no funds are found, we will still be able to teach the course, but the students will have a different experience that will rely more on existing data from modern sky surveys, which is a great experience for the students, but not as encompassing or compelling an experience as understanding the trade-offs of modern astrophysical observing.

Resource Implications

Facilities

Will the program require new or additional facilities or significant improvements to already existing facilities?

No

Technology

Will the program need additional technology beyond what is currently available for the unit?

No

Non-Technical Resources

Will the program require additional supplies, services or equipment (non-technical)?

No

Resources

For each of these items, be sure to include in the response if the proposed new program or change will result in replacement of another program(s). If so, which program(s), what is the anticipated impact on faculty, students, and instructional resources? Please attach any letters of support/acknowledgement from faculty, students, and/or other impacted units as appropriate.

Attach File(s)

MOU - Astrophysics - March 2021 lwl mgp ger.pdf

Faculty Resources

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

At the anticipated enrollment levels listed in this document we do not anticipate an immediate appreciable change in class size, teaching loads, or student-faculty ratios. We are using existing courses in Physics and Astronomy.

Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

Current collections and services are adequate for the proposed program as existing courses from Astronomy, Physics and Mathematics are being used in the curricula.

Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does the program include other courses/subjects impacted by the creation/revision of this program?

Yes

Required courses

PHYS 211 - University Physics: Mechanics
PHYS 212 - University Physics: Elec & Mag
PHYS 213 - Univ Physics: Thermal Physics
PHYS 214 - Univ Physics: Quantum Physics
PHYS 225 - Relativity & Math Applications
PHYS 325 - Classical Mechanics I
PHYS 435 - Electromagnetic Fields I
PHYS 401 - Classical Physics Lab
PHYS 402 - Light
PHYS 404 - Electronic Circuits
MATH 220 - Calculus
MATH 231 - Calculus II
MATH 241 - Calculus III
MATH 285 - Intro Differential Equations
MATH 415 - Applied Linear Algebra

Explain how the inclusion or removal of the courses/subjects listed above impacts the offering departments.

Yes. For an enumerated list of courses please see the proposed courses. The main courses are physics courses, and the Physics Department has agreed to support these courses for our majors.

Attach letters of support from other departments.

Astrophysics MATH letter of support.pdf

Financial Resources

How does the unit intend to financially support this proposal?

The structure of the program minimizes costs since we are using existing courses. To expand the importance of ASTR 414 (to include more real-data access), we are working with the College to identify funds to enhance the student experience.

Will the unit need to seek campus or other external resources?

No

Are you seeking a change in the tuition rate or differential for this program?

Yes

If yes, please enter your college budget office contact information and have them contact provostbudget@illinois.edu for next steps.

Mike Wellens, Director of Budget and Resource Planning: wellens@illinois.edu

Bob Kessler, Assistant Dean Finance & Resource Planning: rkessler@illinois.edu

Market Demand

What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students:

The main market indicator driving this major is our experience with previous double majors in Astronomy and Physics, which this major is effectively replacing due to the discontinuation of the LAS Physics degree. The double major students have been typically our most successful students. The majority of the students would go to graduate school in either Astronomy or Physics. Modern Astronomy is essentially Astrophysics, so this preparation is necessary for our best students to be successful. Those students who choose not to pursue graduate school typically find positions in industry where the rigorous preparation with more physics courses allow them to be very competitive in the job market. No other similar programs exist in the state.

What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

Astronomy/Astrophysics student employment is excellent, typically finding positions in industry along the lines of software development or engineering positions. Astrophysics is a modern synthesis of many skills that build on multiple fields that are in demand with employers. Students are well trained in physics, astronomy, and problem solving, but their problem solving is even more outside the box than many other graduates due to the nature of astronomy— the necessity of being trained when to attack problems in detail and when to approximate the problem. In addition, many of these graduates will be well prepared for graduate school, which is extremely competitive in astronomy, requiring the merging of astronomy and physics.

What resources will be provided to assist students with job placement?

The astronomy advisor will help students with utilizing training and research experience to help students become even more competitive for their goal of either industry or graduate school. The advisor will also assist students in taking advantage of job placement services on campus.

Program Regulation and Assessment

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).

The plan is for the Astronomy advisor to assess the learning objectives for our Astrophysics majors. Success in the advanced astronomy courses requires success in the early prerequisite Physics courses. We will carefully monitor student progress through the first two years of the major in the advising process, giving mentoring where necessary. During the third year, we evaluate the student's progress in the upper level physics and astronomy courses through student and instructor assessments. These reports, coupled with placement knowledge via exit surveys, will provide an overall evaluation of the astrophysics degree, allowing for systematic audits of the program.

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

Program of Study

"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: <https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf>). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.

For new programs, attach Program of Study

BSLAS Astrophysics Overview TAB Academic Catalog Entry.docx
LAS_Astrophysics_Major_2019_v5b.doc

Catalog Page Text

Catalog Page Text: Description of program for the catalog page. This is not official content, it is used to help build the catalog pages for the program. Can be edited in the catalog by the college or department.

Departmental distinction: A student majoring in astrophysics may earn distinction or high distinction by attaining a minimum grade point average of 3.4 or 3.75, respectively, in required major courses (defined in the table below) taken at UIUC. For highest distinction, in addition to meeting the minimum requirements for high distinction, a senior thesis (ASTR 490) must be completed with strong endorsement by the research supervisor. Questions about eligibility for distinction status should be directed to an astronomy advisor before the senior year.

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Minimum required major and supporting course work: Normally equates to 61-68 hours. Twelve hours of 300- and 400-level in the major must be taken on this campus.

Minimum hours required for graduation: 120 hours.

Statement for Programs of Study Catalog

Code	Title	Hours
Core Requirements		17
PHYS 211	University Physics: Mechanics	
PHYS 212	University Physics: Elec & Mag	
PHYS 213	Univ Physics: Thermal Physics	
PHYS 214	Univ Physics: Quantum Physics	
PHYS 225	Relativity & Math Applications	
ASTR 210	Introduction to Astrophysics	
Advanced Requirements		15
Advanced Astronomy		
ASTR 310	Computing in Astronomy ¹	
Select three of the following four courses:		
ASTR 404	Stellar Astrophysics	
ASTR 405	Planetary Systems	
ASTR 406	Galaxies and the Universe	
ASTR 414	Astronomical Techniques	
At least 3 additional hours of approved 300- or 400-level ASTR courses ²		
Advanced Physics		
PHYS 325	Classical Mechanics I	
PHYS 435	Electromagnetic Fields I	
At least 6 additional hours of approved 300- or 400-level PHYS courses ³		
Advanced Laboratory Techniques		
At least one course taken for the Advanced Requirements must be from the following courses:		
ASTR 414	Astronomical Techniques	
PHYS 401	Classical Physics Lab	
PHYS 402	Light	
PHYS 404	Electronic Circuits	
Supporting Technical Courses		18
MATH 220	Calculus ⁴	
MATH 231	Calculus II	
MATH 241	Calculus III	
MATH 285	Intro Differential Equations ⁵	
MATH 415	Applied Linear Algebra	

¹ CS 101 (*Intro. Computing: Engr & Sci*) is recommended as a prerequisite but not required.

² Approved 300- or 400-level ASTR courses. Excluded courses: ASTR 330, ASTR 350, and ASTR 390.

³ Recommended courses include PHYS 326, PHYS 401, PHYS 402, PHYS 404, PHYS 427, PHYS 436, PHYS 470, and PHYS 486. Excluded courses: PHYS 398, PHYS 419, PHYS 420, PHYS 495 and PHYS 497.

⁴ MATH 221 may be substituted for MATH 220. Students with previous calculus experience should consider MATH 221.

⁵ MATH 286 may be substituted for MATH 285.

EP Documentation

DMI Documentation

Program Reviewer Comments

Deb Forgacs (dforgacs) (Thu, 18 Mar 2021 16:21:11 GMT):Rollback: tuition rate question.

Key: 1015

**Memorandum of Understanding between the Colleges of Liberal Arts and Sciences and the
Grainger College of Engineering regarding the establishment of the BSLAS in
Astrophysics**

March 19, 2021

Background and Purpose:

We are creating a new degree—Astrophysics in LAS; the courses needed for this degree span colleges. This MOU helps define the details for the Department of Astronomy and the Department of Physics to ensure student success.

Astronomy and Physics Agreement:

The Department of Astronomy is proposing the course list in Appendix A for the new Astrophysics major. This MOU serves as an agreement between the College of LAS and Grainger College of Engineering regarding the following:

- 1) The Department of Astronomy will provide Physics majors access to all Astronomy courses that are restricted by major, as is already done, excluding ASTR 401 (Scientific Writing for Astronomy), without any funding requirement.
- 2) The Department of Physics will provide Astronomy and Astrophysics majors access to all Physics courses restricted by major, as is already done for Astronomy majors, excluding PHYS 403 (Modern Experimental Physics) and some PHYS 398 special topics offerings. PHYS 403 is a very high demand and costly course which is difficult to staff for Physics majors. However, the other physics laboratory courses are also costly for the Department of Physics to run, so PHYS 401 (Classical Physics Lab), PHYS 402 (Light), and PHYS 404 (Electronic Circuits) will be limited to 5 Astronomy and Astrophysics majors per year. If the number of students is kept below that number, then no additional funding is necessary. If the Department of Astronomy would like to increase this number, the Departments will need a future funding agreement.
- 3) The Physics Department will not provide Astronomy or Astrophysics majors any advising or other CoE student services unless they undertake a dual-degree program or physics minor.
- 4) The Physics Department will continue to include Astronomy, Astrophysics, and CS+Astro majors in their graduation ceremony each Spring. Since our majors share many classes with Physics majors, this provides a cohesive experience.

Duration of Agreement:

This agreement is meant for the foreseeable future, commencing with the implementation of the new Astrophysics degree without termination. If the Astrophysics majors increase beyond **15** students per year, either Department can petition for a change to this MOU. Any changes to this agreement must allow for the current Astrophysics freshmen to finish their Astrophysics degree.

APPENDIX A:

Code	Title	Hours
Core Requirements		17
PHYS 211	University Physics: Mechanics	
PHYS 212	University Physics: Elec & Mag	
PHYS 213	Univ Physics: Thermal Physics	
PHYS 214	Univ Physics: Quantum Physics	
PHYS 225	Relativity & Math Applications	
ASTR 210	Introduction to Astrophysics	
Advanced Requirements		
Advanced Astronomy		15
ASTR 310	Computing in Astronomy ¹	
Select three of the following four courses:		
ASTR 404	Stellar Astrophysics	
ASTR 405	Planetary Systems	
ASTR 406	Galaxies and the Universe	
ASTR 414	Astronomical Techniques	
At least 3 additional hours of approved 300- or 400-level ASTR courses ²		
Advanced Physics		12
PHYS 325	Classical Mechanics I	
PHYS 435	Electromagnetic Fields I	
At least 6 additional hours of approved 300- or 400-level PHYS courses³		
Advanced Laboratory Techniques		
At least one course taken for the Advanced Requirements must be from the following courses:		
ASTR 414	Astronomical Techniques	
PHYS 401	Classical Physics Lab	
PHYS 402	Light (with Lab)	
PHYS 404	Electronic Circuits	
Supporting Technical Courses		18
MATH 220	Calculus ⁴	
MATH 231	Calculus II	
MATH 241	Calculus III	
MATH 285	Intro Differential Equations ⁵	
MATH 415	Applied Linear Algebra	


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⁵ MATH 286 may be substituted for MATH 285.




Leslie W. Looney
Chair, Department of Astronomy

Mar 17, 2021
Date



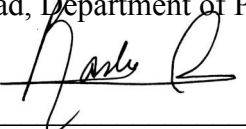
Gene E. Robinson
Interim Dean, College of Liberal Arts and Sciences

March 19, 2021
Date



Matthias Grosse Perdekamp
Head, Department of Physics

3-17-2021
Date



Rashid Bashir
Dean, Grainger College of Engineering

3-22-2021
Date



MATHEMATICS

College of Liberal Arts & Sciences
273 Altgeld Hall, MC-382
1409 W. Green Street
Urbana, IL 61801 USA

March 19, 2021

To the members of the Senate Educational Policy Committee:

The Department of Mathematics supports the proposal by the Department of Astronomy to establish a degree in Astrophysics. We acknowledge the inclusion of the following MATH courses in the curriculum as required courses for this new major:

Calculus, Calculus II and Calculus III: MATH 220, MATH 231 and MATH 241
Differential Equations: MATH 285
Linear Algebra: MATH 415

The Mathematics Department is prepared to handle the anticipated increase in enrollments in these courses due to this new major.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jeremy Tyson'.

Jeremy Tyson
Professor and Chair
Department of Mathematics
University of Illinois at Urbana-Champaign



Proposal for new curricula (degree, major, concentration, minor)

Submit completed proposals via email to Associate Dean Kelly Ritter (ritterk@illinois.edu). Please obtain Executive Officer and School Director (if applicable) approval via email and forward with the proposal to LAS.

Proposal Title: Establish a New Bachelor of Science in Liberal Arts and Sciences Major in Astrophysics in the Department of Astronomy, College of LAS.

For proposals with concentrations- N/A.

Proposed effective date: Fall 2022.

Sponsor(s): Leslie Looney, Chair, Department of Astronomy, lwl@illinois.edu. 217-244-3615

College contact: Kelly Ritter, Associate Dean for Curricula and Academic Policy, College of Liberal Arts and Sciences, ritterk@illinois.edu

Is this program interdisciplinary? No.

For Minors ONLY-

1) Is this minor: N/A

- A comprehensive study in a single discipline
- An interdisciplinary study focusing on a single theme
- Exception

2) Please include how the proposed minor requires some depth in the subject, but not as extensive as the major. N/A

PROGRAM DESCRIPTION and JUSTIFICATION

1) Provide a brief description but concise description of your proposal. For example, if proposing revisions to a curriculum, state specifically what is changing. Where applicable, note whether stated program changes include additional requirements in the form of prerequisite courses. Requests for curriculum revisions must be accompanied by a table which clearly outlines the current requirements and the proposed revisions. This information may be submitted as an appendix. See Appendix A for an example. Please provide pertinent information only.

This proposal seeks to establish a new BSLAS Astrophysics major in the Department of Astronomy (LAS) in addition to the existing BSLAS Astronomy major. No change is proposed to the existing Astronomy major.

2) **Provide a justification of the program**, including how your unit decided to create this program, highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

A new Astrophysics major is being proposed that will provide Astronomy majors with a pathway to achieve a full astrophysics experience. (Modern astronomy is astrophysics.) The Department of Astronomy has two main populations of majors: 1) students who only want the minimum required number of physics courses, expecting to use their interdisciplinary skills in industry, and 2) students who want more physics courses to be rigorously prepared for graduate school or other more technical professions. To date, the latter group have typically achieved this preparation **by obtaining a double major or dual degree in LAS Physics.**

With the **proposed consolidation of several Physics degrees into a single program within the Grainger College of Engineering (GCOE)**, the existing LAS Physics degree program will be phased out. **As a result of this change, students will not be able to double major in Physics and Astronomy. Instead, students would have to pursue a dual degree, which requires an additional 30 credit hours and satisfying the requirements of both the college of Liberal Arts and Sciences (LAS) and the GCOE. In addition, entry to the GCOE is only possible upon matriculation to the University or via application to the PREP program before the end of freshman year. Furthermore, a physics minor alone does not give our Astronomy majors enough flexibility necessary to prepare them fully for astrophysics graduate school, especially graduate programs in joint Astronomy/Physics Departments.** Over the last 5 years, the competition for graduate school has dramatically increased. (For example, at Illinois we accepted ~7% of astronomy graduate applicants for AY20-21.) Our goal, with the creation of a new Astrophysics major in the Department of Astronomy, is to provide an unsurpassed rigorous preparation for our best students. Leveraging two great Departments, Astronomy and Physics, on campus, this new major will provide students with one of the most flexible astronomy and astrophysics options for students in the country.

3) *In addition, please provide an answer as to how your degree (120 hours of coursework) will satisfy this requirement: IBHE requires that all degree programs contain at least 40 credit hours in upper division courses as part of their overall degree. Not all 40 hours need to be in your major. Simply state how many of those 40 hours are achieved in your major. Upper division courses have been described as 300- and 400- level coursework and some 200-level courses in which multiple prerequisites are required.*

The current curriculum includes 34-40 credit hours of upper division courses.

INSTITUTIONAL CONTEXT (new majors and degrees ONLY)

University of Illinois at Urbana-Champaign

Mission: The University of Illinois at Urbana-Champaign is charged by our state to enhance the lives of the citizens in Illinois, across the nation and around the world through our leadership in learning, discovery, engagement and economic development.

1) Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built. Also, explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

The historical context of this new program arises fundamentally from the fact that the Department of Physics resides within the Grainger College of Engineering while other physical sciences, such as Chemistry, Mathematics, Statistics, Atmospheric Sciences, Geology, Chemistry, and Astronomy, among others, reside within the College of LAS; the Physics degree programs have been split between colleges. While the Department of Physics is within the GCOE, there have been three Physics degree programs administered by LAS. These LAS degree programs have provided opportunities for students to explore Physics and Astronomy together through double majors, but also caused some confusion and variations in services. The Physics Department is advancing a proposal to consolidate all Physics degree programs into the GCOE to better serve Physics students at Illinois.

The new Astrophysics major is an adaptation **to this change** that best allows us to serve the mission of the University of Illinois and best prepare our students. The new major will build on the existing Astronomy major and on the existing courses offered by the Department of Physics. The proposal for an Astrophysics major in Astronomy has been extensively discussed with Physics as part of their broader changes and has their approval as an academic accommodation to these developments. By mutual agreement the students in the Astrophysics major will have access to the courses included in our proposed curriculum. In addition, to best prepare our astrophysics students, we will be enhancing our astrophysical laboratory course (ASTR 414, Astronomical Techniques).

University of Illinois

University of Illinois' mission: The University of Illinois will transform lives and serve society by education, creating knowledge and putting knowledge to work on a large scale and with excellence.

2) Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

The goal of this new major is to maintain excellence in the education of students in astronomy and astrophysics. Due to the close academic relationship between the disciplines of physics and astronomy, this new Astrophysics degree contains a rich preparation in foundational Physics so that students are prepared for future advanced study in astronomy (which is really astrophysics) and for advanced technical employment. We have built into our program a unique flexibility that allows students to choose which courses best match their goals and to provide a title (astrophysics) that is more in line with the rigor of the required courses.

State of Illinois

The Public Agenda for Illinois Higher Education is a planning blueprint for the State of Illinois to direct state policies and resources to the higher education and career needs of Illinois residents and to address the current and future economic needs of the state.

3) Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)

- Educational Attainment - increase educational attainment to match the best-performing states.
- College Affordability - ensure college affordability for students, families, and taxpayers.
- High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.
- Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

This program will meet the enumerated goals of the Illinois Board of Higher Education's (IBHE) Strategic Initiative. The program meets the goal of *Educational Attainment* by sustaining an option for students to graduate with a rigorous preparation in Astrophysics, as required for many graduate schools, and in order to match commensurate academic offerings in peer institutions in other states. The program addresses College Affordability by retaining the tuition schedule in place for the existing Astronomy major. The new major prepares students for advanced study or technical careers and therefore helps to provide *High Quality Credentials to Meet Economic Demand*. This new major integrates and efficiently deploys campus strengths in two disciplines and therefore provides closer *Integration of Educational, Research and Innovation Assets*.

4) Describe how the proposed program supports the goals above:

ADMISSION REQUIREMENTS

Desired admissions term: *For LAS units, a fall semester effective term for all curricula will be requested, please indicate the proposed year*

Fall, 2022

Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

The admissions requirements are the standard for campus at the undergraduate level.

Describe how critical academic functions such as admissions and student advising are managed.

Admissions are handled through campus. The astronomy advisor will be used for student advising, which has capacity. Students meet with the advisor every semester where classes, plans, and professional development are discussed.

ENROLLMENT

1) Number of students in program estimates

Year 1 estimate: 12

Year 5 estimate (or when fully implemented): 50

We used current graduates dual-majors and minor students as our Year 1 estimate, then assuming the retention plus the likelihood of recruiting students to this new and exciting major. On the other hand, the majority of these will likely be pulled from the Astronomy degree, but those students will be Astronomy majors first, instead of LAS physics majors.

2) Estimated Annual Number of Degrees Awarded (degrees, majors and concentrations ONLY)

Year 1: 0

Year 5 (or when fully implemented): 13

3) Delivery Method, what is the program's primary delivery method? Choose from following:

Face to Face; Online & Face to Face; Online Only; Other- specify: Face to Face.

BUDGET

1) Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available? If yes, please describe.

This is a new major with rigorous requirements in physics and astrophysics that will provide our students essential training for graduate school or other technical professions. We have taken care to craft this new major from existing courses in Astronomy and Physics. A student in the new major will need experience working with real data in an experimental or laboratory setting including data acquisition, analysis, and statistical and scientific interpretation. Although, this requirement can be fulfilled by physics courses, it is also important to allow students to have direct access to modern astrophysics observations. As such we propose to strengthen the laboratory component of ASTR 414 (Astronomical Techniques) to include a richer experience with astronomical data acquired during the semester. The Department of Astronomy is working with LAS to identify funding opportunities to expand this course. If no funds are found, we will still be able to teach the course, but the students will have a different experience that will rely more on existing data from modern sky surveys, which is a great experience for the students, but not as encompassing or compelling an experience as understanding the trade-offs of modern astrophysical observing.

2) Please provide any additional budget information needed to effectively evaluate the proposal.

Please see the following sections.

RESOURCE IMPLICATIONS

1) Facilities- Will the program require new or additional facilities or significant improvements to already existing facilities? If yes, please outline the specific need and Year 1 and Year 5 cost.

As described above, the program will enhance ASTR 414 (Astronomical Techniques) as a more complete laboratory course. The Department of Astronomy is working with the college to secure access to telescope and other equipment that will be necessary in the curricular work of the Astrophysics major. No other new facilities are needed to implement the degree program.

2) Technology- Will the program need additional technology beyond what is currently available for the unit? If yes, please outline the specific need and Year 1 and Year 5 cost.

N/A.

3) Non-Technical Resources- Will the program require additional supplies, services or equipment (non-technical)? If yes, please outline the specific need and Year 1 and Year 5 cost.

N/A.

RESOURCES

1) Faculty Resources: Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

At the anticipated enrollment levels listed in this document we do not anticipate an immediate appreciable change in class size, teaching loads, or student-faculty ratios. We are using existing courses in Physics and Astronomy.

2) Library Resources: Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

Current collections and services are adequate for the proposed program as existing courses from Astronomy, Physics and Mathematics are being used in the curricula.

3) Instructional Resources: Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change? If yes, please describe.

No.

4) Does this new program/proposed change result in the replacement of another program? If yes, please specify the program.

No.

5) Does the program include any required or recommended subjects that are offered by other departments? If yes, please list the courses. Explain how these additional courses will be used by the program and provide letters of support from the departments.

Yes. For an enumerated list of courses please see the proposed courses. The main courses are physics courses, and the Physics Department has agreed to support these courses for our majors.

FINANCIAL RESOURCES

1) How does the unit intend to financially support this proposal?

The structure of the program minimizes costs since we are using existing courses. To expand the importance of ASTR 414 (to include more real-data access), we are working with the College to identify funds to enhance the student experience.

2) Will the unit need to seek campus or other external resources? If yes, please provide a summary of the sources and an indication of the approved support.

No.

3) Will an existing tuition rate be used or continue to be used for this program? (degrees, majors and concentrations ONLY)

The tuition rate for the BSLAS Astrophysics degree will be set to that of the BSLAS Astronomy degree.

4) Is this program requesting self-supporting status? (degrees, majors and concentrations ONLY)

No.

Market Demand

What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students:

The main market indicator driving this major is our experience with previous double majors in Astronomy and Physics, which this major is effectively replacing due to the discontinuation of the LAS Physics degree. The double major students have been typically our most successful students. The majority of the students would go to graduate school in either Astronomy or Physics. Modern Astronomy is essentially Astrophysics, so this preparation is necessary for our best students to be successful. Those students who choose not to pursue graduate school typically find positions in industry where the rigorous preparation with more physics courses allow them to be very competitive in the job market. No other similar programs exist in the state.

What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

Astronomy/Astrophysics student employment is excellent, typically finding positions in industry along the lines of software development or engineering positions. Astrophysics is a modern synthesis of many skills that build on multiple fields that are in demand with employers. Students are well trained in physics, astronomy, and problem solving, but their problem solving is even more outside the box than many other graduates due to the nature of astronomy— the necessity of being trained when to attack problems in detail and when to approximate the problem. In addition, many of these graduates will be well prepared for graduate school, which is extremely competitive in astronomy, requiring the merging of astronomy and physics.

What resources will be provided to assist students with job placement?

The astronomy advisor will help students with utilizing training and research experience to help students become even more competitive for their goal of either industry or graduate school. The advisor will also assist students in taking advantage of job placement services on campus.

PROGRAM REGULATION

1) Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable.

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning.

The plan is for the Astronomy advisor to assess the learning objectives for our Astrophysics majors. Success in the advanced astronomy courses requires success in the early prerequisite

Physics courses. We will carefully monitor student progress through the first two years of the major in the advising process, giving mentoring where necessary. During the third year, we evaluate the student's progress in the upper level physics and astronomy courses through student and instructor assessments. These reports, coupled with placement knowledge via exit surveys, will provide an overall evaluation of the astrophysics degree, allowing for systematic audits of the program.

2) Is the career/profession for graduates of this program regulated by the State of Illinois? If yes, please describe.

N/A.

ACADEMIC CATALOG ENTRY

All proposals must submit the major requirements (courses, hours) for the proposed curricula. Please see the University of Illinois Academic Catalog- <http://catalog.illinois.edu/> for your unit for an example of the entry.

Astrophysics, BSLAS

for the degree of Bachelor of Science in Liberal Arts & Sciences Major in Astrophysics

Departmental distinction: A student majoring in astrophysics may earn distinction or high distinction by attaining a minimum grade point average of 3.4 or 3.75, respectively, in required major courses (defined in the table below) taken at UIUC. For highest distinction, in addition to meeting the minimum requirements for high distinction, a senior thesis (**ASTR 490**) must be completed with strong endorsement by the research supervisor. Questions about eligibility for distinction status should be directed to an astronomy advisor before the senior year.

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Minimum required major and supporting course work: Normally equates to 61-68 hours. Twelve hours of 300- and 400-level in the major must be taken on this campus.

Minimum hours required for graduation: 120 hours.

Code	Title	Hours
Core Requirements		17
<u>PHYS 211</u>	University Physics: Mechanics	
<u>PHYS 212</u>	University Physics: Elec & Mag	
<u>PHYS 213</u>	Univ Physics: Thermal Physics	
<u>PHYS 214</u>	Univ Physics: Quantum Physics	
PHYS 225	Relativity & Math Applications	

<u>ASTR 210</u>	Introduction to Astrophysics	
Advanced Requirements		
Advanced Astronomy		15
ASTR 310	Computing in Astronomy ¹	
Select three of the following four courses:		
<u>ASTR 404</u>	Stellar Astrophysics	
<u>ASTR 405</u>	Planetary Systems	
<u>ASTR 406</u>	Galaxies and the Universe	
<u>ASTR 414</u>	Astronomical Techniques	
At least 3 additional hours of approved 300- or 400-level ASTR courses ²		
Advanced Physics		12
PHYS 325	Classical Mechanics I	
PHYS 435	Electromagnetic Fields I	
At least 6 additional hours of approved 300- or 400-level PHYS courses³		
Advanced Laboratory Techniques		
At least one course taken for the Advanced Requirements must be from the following courses:		
ASTR 414	Astronomical Techniques	
PHYS 401	Classical Physics Lab	
PHYS 402	Light (with Lab)	
PHYS 404	Electronic Circuits	
Supporting Technical Courses		18
<u>MATH 220</u>	Calculus ⁴	
<u>MATH 231</u>	Calculus II	
<u>MATH 241</u>	Calculus III	
MATH 285	Intro Differential Equations ⁵	
MATH 415	Applied Linear Algebra	

¹ CS 101 (Intro. Computing: Engr & Sci) is recommended as a prerequisite but not required.

² Approved 300- or 400-level ASTR courses. Excluded courses: ASTR 330, ASTR 350, and ASTR 390.

³ Recommended courses include PHYS 326, PHYS 401, PHYS 402, PHYS 404, PHYS 427, PHYS 436, PHYS 470, and PHYS 486. Excluded courses: PHYS 398, PHYS 419, PHYS 420, PHYS 495, and PHYS 497.

⁴ MATH 221 may be substituted for MATH 220. Students with previous calculus experience should consider MATH 221.

⁵ MATH 286 may be substituted for MATH 285.

ACADEMIC CATALOG ENTRY

Overview TAB

Astrophysics, BSLAS

for the degree of Bachelor of Science in Liberal Arts & Sciences Major in Astrophysics

department website: <https://astro.illinois.edu/>

department faculty: [Astronomy Faculty](#)

overview of college admissions & requirements: [Liberal Arts & Sciences](#)

college website: <https://las.illinois.edu/>

email: astronomy@illinois.edu

The Department of Astronomy also offers a [BSLAS in Computer Science & Astronomy](#)