ARIZONA STATE UNIVERSITY

PROPOSAL TO ESTABLISH A NEW UNDERGRADUATE DEGREE PROGRAM

This template is to be used only by programs that have received specific written approval from the Provost's office to proceed with internal proposal development and review. The proposal template should be completed in full and submitted to the University Provost's Office [mailto: curriculumplanning@asu.edu]. It must undergo all internal university review and approval steps including those at the unit, college and university levels. A program **may not** be implemented until the Provost's Office notifies the academic unit that the program may be offered.

College/School/Institute:	The College of Liberal Arts and Sciences
Department/Division/School:	School of Earth and Space Exploration
Proposing faculty group (*if applicable*):	
Are two or more academic units collaborating on this program?	No, this is not a joint degree program

If "Yes", list all the additional college(s)/school(s)/institute(s) that will be involved in the development and resources for the degree program by offering courses, faculty or facilities. Please note: This question does not refer to official joint degree programs. Official joint degree programs are ones in which the degree is jointly conferred by two colleges. If the program is jointly conferred, please complete the Proposal to Establish a New Joint Undergraduate Degree Program.

Degree type:	BS-Bachelor of Science
If other; provide degree type title and proposed abbreviation:	
Name of degree program (major):	Astronomical and Planetary Sciences
Are any concentrations to be established under this degree program?	No, concentrations will not be established.
What is the first catalog year available for students to select on the undergraduate application for this this program?	2020-21

Delivery method and campus or location options: select all locations that apply

☐ Downtown Phoenix ☐ Polytechnic ☐ Tempe ☐ Thunderbird ☐ West ☐ Other: _____

☐ **Both** on-campus **and** ☐ ASU Online* - (check applicable campus(es) from options listed above)

☒ ASU Online only (all courses online and managed by ASU Online)

Note: Once students elect a campus or online option, students will not be able to move between the on-campus and the ASU Online options. Approval from the Office of the University Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online. Please contact Ed Plus then complete the ASU Online Offering form in Curriculum ChangeMaker to begin this request.

Proposal Contact

Name:	Christopher Groppi	**Title:**	Associate Professor, Associate Director for Undergraduate Education
Phone number:	480-965-6436	**Email:**	cgroppi@asu.edu

DEAN APPROVAL(S)

This proposal has been approved by all necessary unit and College/School levels of review. I recommend implementation of the proposed organizational change.

College/School/Division Dean name: Paul LePore

Signature: Paul LePore **Date:** 11/21/2019

College/School/Division Dean name: *(if more than one college involved)*

Signature: _____ **Date:** / /20

Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.

1. Purpose and Nature of Program

Provide a brief program description. Include the distinctive features of the program that make it unique.

The School of Earth and Space Exploration faculty have identified a need for an astronomy degree designed to prepare students for careers other than those requiring doctoral degrees. The Bachelor of Science in Astronomical and Planetary Sciences would be offered online as a general liberal arts and sciences degree, in contrast to the Earth and Space Exploration Bachelor of Science with a concentration in Astrophysics, which is designed as a graduate school preparatory program. Based on feedback from current and potential students, there is a large population of students who have a great interest in astronomy, but do not desire to pursue PhD in the subject. This degree will improve accessibility to an education in astronomy by innovating a first-of-its kind degree: the only online astronomy bachelor's degree offered anywhere in the world.

2. Student Learning Outcomes and Assessment Methods

Assessment Plan

Attach a PDF copy of the assessment plan printed from the University Office of Evaluation and Educational Effectiveness assessment portal demonstrating UOEEE's approval of your assessment plan for this program. Visit the assessment portal at https://uoeee.asu.edu/assessment-portal or contact uoeee@asu.edu with any questions.

3. Academic Curriculum and Requirements

A. Major Map

Attach a copy of the "proposed" major map for this degree program. If this program will be delivered online as well as in-person, attach a copy of both the major map and the online major map. Instructions on how to create a "proposed major map" in BAMM can be found in the Build a Major Map Training Guide.

B. Summary of Credit Hours Required for this Program

Total credit hours must be 120 and include first year composition, general studies, core/required courses, program specific electives, and any additional requirements (e.g., concentration credits).

Requirements	Credit Hours
First Year Composition	6
ASU 101 (or equivalent)	1
General Studies	24
Core/required courses	44
Program specific electives	15
Additional requirements	0
Other; please explain University Electives and The College Science & Society	30
Total	**120**

C. Curriculum Checksheet

Attach a PDF copy of the curriculum checksheet from BAMM to the proposal submission. The curricular checksheet should outline all core/required courses and program specific electives. To retrieve the checksheet in BAMM:

1. Select the "Checksheet" tab for the program.
2. From the tab, select "Preview Checksheet." The preview will open in a new window.
3. Select "Save as PDF" in upper right-hand corner of the page.

2020 Course List for
Astronomical and Planetary Sciences (BS) (Proposed) - (ONLINE)

The College of Liberal Arts and Sciences | TUTJWJN

Major Requirements	Credit Hours	Min. Grade
Astronomical and Planetary Sciences CORE (30 semester hours)		
AST 111: Introduction to Solar Systems Astronomy (SQ) AND AST 113: Astronomy Laboratory I (SQ)	4	C
AST 112: Introduction to Stars, Galaxies, and Cosmology (SQ) AND AST 114: Astronomy Laboratory II (SQ)	4	C
AST 301: Physics of Astrophysics	3	C
AST 321: Introduction to Planetary and Stellar Astrophysics (SQ)	3	C
AST 322: Introduction to Galactic and Extragalactic Astrophysics (SQ)	3	C
SES 106: Habitable Worlds (SQ)	4	C
SES 350: Engineering Systems and Experimental Problem Solving	3	C
SES 376: Communicating Astronomical and Planetary Sciences I	3	C
SES 377: Communicating Astronomical and Planetary Sciences II	3	C
Major Electives (15 semester hours)		
Astronomical and Planetary Sciences Major Elective	9-12	C
Upper Division Astronomical and Planetary Sciences Major Elective	6-7	C
Related Area (14 semester hours)		
MAT 170: Precalculus (MA)	3	C
MAT 210: Brief Calculus (MA)	3	C
PHY 111: General Physics (SQ) AND PHY 113: General Physics Laboratory (SQ)	4	C
PHY 112: General Physics (SQ) AND PHY 114: General Physics Laboratory (SQ)	4	C
College Requirements		
Science and Society Elective	3	C
Upper Division Science and Society Elective	3	C

Electives	Credit Hours	Min. Grade
General Electives		
Elective	12-9	
Upper Division Elective	12-11	

Track/Groups

Astronomical and Planetary Sciences Major Electives	Upper Division Astronomical and Planetary Sciences Major Electives
BIO 181: General Biology I (SQ)	BIO 340: General Genetics
BIO 182: General Biology II (SG)	BIO 345: Evolution
BIO 340: General Genetics	MAT 343: Applied Linear Algebra
BIO 345: Evolution	MCO 307: The Digital Audience
CHM 113: General Chemistry I (SQ)	MCO 335: Social Media
CHM 114: General Chemistry for Engineers (SQ)	MCO 425: Digital Media Literacy I
CHM 116: General Chemistry II (SQ)	PHI 314: Philosophy of Science (HU)
GLG 101: Introduction to Geology I (Physical) (SQ)	TWC 401: Fundamentals of Technical Communication (L)

GLG 103: Introduction to Geology I-Laboratory (SQ)
MAT 275: Modern Differential Equations (MA)
MAT 343: Applied Linear Algebra
MCO 307: The Digital Audience
MCO 335: Social Media
MCO 425: Digital Media Literacy I
PHI 314: Philosophy of Science (HU)
TWC 401: Fundamentals of Technical Communication (L)
TWC 446: Technical and Scientific Reports (L)
SES 141: Energy In Everyday Life (SQ)
STP 226: Elements of Statistics (CS)

TWC 446: Technical and Scientific Reports (L)

D. Concentrations

i. Are any concentrations to be established under this degree program? No, concentrations will not be established.

ii. If yes, are concentrations required? (Select One)

iii. List courses & additional requirements for the proposed concentration(s)

Concentration Name	Total credit hours	Core/Required Courses for Concentration (Prefix, # & Title)	Total Core credit hours	Program Specific Electives (include course name and prefix)	Total Elective credit hours	Additional Requirements (i.e. milestones, capstones)

4. New Course Development

A. Will a new course prefix (es) be required for this degree program? No
If yes, list prefix name(s) (i.e. ENG- English):

Note: A request for a New Prefix form must be completed for each new prefix required and submitted with this proposal: New prefix request form.

B. New Courses Required for Proposed Degree Program
List all new courses required for this program, including course prefix, number and course description.

AST 301 Physics of Astrophysics (3)

This is an online course that is designed to develop critical physical and mathematical concepts for contemporary astrophysics. Students are assumed to have prior knowledge of algebra and calculus. Through the textbook, the course will introduce students to a variety of physical forces in the context of astrophysical processes, including electromagnetic interactions and light, gravity and motion, interactions between light and matter in astrophysical systems, and the strong (nuclear) force responsible for the fusion processes fueling stars. Students will also explore related concepts such as conservation of energy and momentum and gain experience with applying these concepts using mathematical techniques to broaden their understanding of the Universe by working analytic problem sets and implementing simple computer programs.

SES 376 Communicating Astronomical and Planetary Sciences I (3)

This is an online course that is designed to develop science communication writing skills, specifically focusing on communicating scientific concepts and scientific results to a variety of audiences including astronomers and the general public. Through lectures, readings and discussions, the course will introduce students to the characteristics of written science communication and public engagement within the context of astronomical and planetary sciences to include investigations into the ethics of science communication. Students will gain proficiencies in science communication writing, visual data production and various digital technologies through relevant, project-based assignments, digital portfolio creation and contributions to a class blog.

SES 377 Communicating Astronomical and Planetary Sciences II (3)

This is an online course that is designed to develop science communication oral skills, specifically focusing on communicating scientific concepts and scientific results to a variety of audiences including astronomers and the general public. Through lectures, readings and discussions, the course will introduce students to a variety of techniques for

producing and presenting effective oral science presentations within the context of astronomy and planetary sciences. Students will gain proficiencies in public speaking, visual data production and various digital technologies through relevant, project-based assignments, including digital portfolio creation and contributions to a class blog.

Note: New course requests must be submitted electronically via Curriculum ChangeMaker and undergo all internal university review and approval steps including those at the unit, college, and university levels.

5. Program Need

Explain why the university needs to offer this program (include target audience and market).

The faculty's committee has identified only two natural science four-year bachelor's degrees from accredited institutions online: A geosciences degree from Florida State University and a space sciences degree from American International University. Although a few online astronomy master's degrees exist, the proposed degree would be the first online astronomy bachelor's degree offered anywhere in the world. This reveals a significant untapped market for a rigorous natural science degree online. The proposed online Astronomical and Planetary Sciences, BS will offer students not interested in continuing on to graduate school the same degree opportunity as the popular immersion Bachelor of Arts in Earth and Environmental Studies, and should prove just as popular.

6. Collaboration and Impact

i. List other academic units that might be impacted by the proposed program and describe the potential impact (e.g., how the implementation of this program might affect student headcount/enrollment, student recruitment, faculty participation, course content, etc. in other programs).

The proposed degree requires introductory mathematics and physics courses that are already offered online by the Physics and Mathematics departments. This degree would increase enrollment in those courses by ~200 students. We do not expect this to be a significant impact because the fractional enrollment increase is modest for these very popular high enrollment courses. The only other impacts are for courses on the approved elective list, and enrollment for general studies courses. All the courses in these categories are also online already. Enrollment increases will be very modest (well under 50 students per course) because the expected 200 students per year in this major will be distributed amongst a large number of possible courses based on individual student interest.

ii. Attach a letter of collaboration and impact from each Dean, or Dean's designee at the Assistant or Associate Dean level, from impacted programs. Refer to the Provost's Office Curriculum Development website (https://provost.asu.edu/node/3227) for guidelines on collaboration and impact statements.

7. Projected Enrollment

How many new students do you anticipate enrolling in this program each year for the next five years?

5-YEAR PROJECTED ANNUAL ENROLLMENT					
	1st Year	**2nd Year** (Yr 1 continuing + new entering)	**3rd Year** (Yr 1 & 2 continuing + new entering)	**4th Year** (Yrs 1, 2, 3 continuing + new entering)	**5th Year** (Yrs 1, 2, 3, 4 continuing + new entering)
Number of Students Majoring (Headcount)	100	200	300	500	800

8. Accreditation or Licensing Requirements

If applicable, provide the names of the external agencies for accreditation, professional licensing, etc. that guide your curriculum for this program, if any. Describe any requirements for accreditation or licensing.

None Required

9. Faculty & Staff

A. Current Faculty

List the name, rank, highest degree obtained, and area of specialization or expertise of all current faculty who will teach in the program, and estimate their level of involvement.

A. Current Faculty

List the name, rank, highest degree obtained, and area of specialization or expertise of all current faculty who will teach in the program, and estimate their level of involvement.

Ariel Anbar, Professor, PhD, Astrobiology, developed and teaches SES 106, a required course for the proposed degree.

Jim Bell, Professor, PhD, Planetary Science, Teaches introductory astronomy courses, will develop a lower level planetary science elective class in the future.

Sanchayeeta Borthakur, Assistant Professor, PhD, Extragalactic Astronomy, Teaches introductory astronomy courses and AST 322.

Maitrayee Bose, Assistant Professor, PhD, Planetary Science, Teaches introductory astronomy courses

Catherine Bowman, PhD, Associate Research Scientist, Science Education, educational effectiveness and assessment

Judd Bowman, PhD, Associate Professor, Cosmology, Teaches introductory astronomy courses and AST 322

Nathanial Butler, PhD, Associate Professor, Extragalactic Astronomy, Teaches introductory astronomy courses and AST 321, developed and teaches SES 350

Steven Desch, PhD, Professor, Planetary Science and Galactic Astronomy, Teaches AST 321

Christopher Groppi, PhD, Associate Professor, Instrumentation and Galactic Astronomy, Teaches introductory astronomy courses, AST321

Craig Hardgrove, PhD, Assistant Professor, Planetary Science, Teaches introductory astronomy courses

Daniel Jacobs, PhD, Assistant Professor, Extragalactic Astronomy and Instrumentation, Teaches introductory astronomy courses, AST 322, SES 350

Karen Knierman, PhD, Lecturer, Extragalactic astronomy and astronomy education, Teaches introductory astronomy courses. Primary job description is teaching and developing intro courses for the proposed major.

Michael Line, PhD, Assistant Professor, Galactic astronomy and planetary science, Teaches introductory astronomy courses and AST 321.

Philip Mauskopf, PhD, Professor, Cosmology and instrumentation, Teaches AST 322.

Jennifer Patience, PhD, Associate Professor, Galactic astronomy, teaches introductory astronomy courses and AST 321.

Alyssa Rhoden, PhD, Assistant Professor, planetary science, teaches introductory astronomy courses.

Evan Scannapieco, PhD, Associate Professor, extragalactic astronomy, teaches introductory astronomy courses, AST 322 and SES350.

Evgenya Shkolnik, PhD, Associate Professor, galactic astronomy, teaches introductory astronomy courses and AST 321.

Francis Timmes, PhD, Professor, galactic astronomy, teaches introductory astronomy courses, will develop a lower level astronomy elective course in the future.

Meenakshi Wadhwa, PhD, Professor, planetary science, teaches introductory astronomy courses

Sara Walker, PhD, Associate Professor, Astrobiology, teaches SES 106

Rogier Windhorst, PhD, Professor, extragalactic astronomy, teaches introductory astronomy courses, AST 322

Patrick Young, PhD, Associate Professor, galactic astronomy, teaches introductory astronomy courses, will develop online AST 321, teaches AST 321.

B. New Faculty

Describe the new faculty hiring needed during the next three years to sustain the program. List the anticipated hiring schedule and financial sources for supporting the addition of these faculty members.

Dr. Knierman was recently hired into a permanent position under funding entirely from the School of Earth and Space Exploration. Dr. Knierman is required for the life of the degree to make the teaching of the degree feasible. The existing astronomy and planetary science faculty in the school must teach the in-person courses required for the Earth and Space Exploration BS degrees as well as support this degree. The addition of the online BS makes a permanent faculty instructor a requirement for degree success. Funding from degree tuition reimbursement to the school and funding from program fees should be able to continuously fund this permanent position, relieving the financial burden on SESE operations funding. We then plan to supplement this position with a second instructor from funds generated by the degree. The university has just approved a search for a tenure-track discipline-based education researcher, who we expect will be deeply involved in this degree program.

C. Administration of the Program

Explain how the program will be administered for the purposes of admissions, advising, course offerings, etc. Discuss the available staff support.

The School of Earth and Space Exploration currently has 3 people who handle the undergraduate and graduate academic programs which currently includes about 550 students. The increase in enrollments from this major necessitates the hiring of another Academic Success Specialist dedicated to this program. The hire of this specialist (listed in the budget as an academic advisor) is funded through the degree income from credit hours and program fees. In addition, a program coordinator will be hired to manage the degree development and operation. We believe this person can be an existing ETX center employee partially funded by the proposed degree. We will also have on staff a dedicated IT support person for both degree and student IT support, a dedicated software developer to produce and maintain interactive online tools, a learning designer to design the online learning experience, and a project manager to manage the creation of new courses and migration to online of existing courses.

10. Resources (necessary to launch and sustain the program)

A. Required Resources

Describe any new resources required for this program's success, such as new support staff, new facilities, new library resources, new technology resources, etc.

The revenue from enrollment of the degree is expected to be able to fully fund the operation of the degree and all the necessary personnel. The resources required include: 1) Staff: Academic Success Specialist, IT support person, program coordinator and software developer. (Ideally, staff will be hired ~3 months before the launch of the degree to ensure the degree operates smoothly from the first day). 2) Online course development, which will require both school, college and EdPlus resources.

B. Resource Acquisition

Explain how the resources to support this program will be obtained.

We will work with the college and school to identify sources of funding to obtain the resources required above. We have already started this process with both internal investment and internal funding proposals.

APPENDIX
OPERATIONAL INFORMATION FOR UNDERGRADUATE PROGRAMS

(This information is used to populate the Degree Search/catalog website.)

1. **Program Name (Major):** Astronomical and Planetary Sciences

2. **Marketing Description** (*Optional.* 50 words maximum. The marketing description should not repeat content found in the program description)

   Explore humanity's place in the universe, from near-Earth orbit to the edge of the observable universe. In this program, you will develop critical thinking, problem solving and communication skills in the process of your scientific inquiry.

3. **Program Description** (150 words maximum)

   The online BS program in astronomical and planetary sciences provides broad training in the scientific foundations required to understand and communicate the fundamentals of space exploration and ongoing advances in the field. The degree program includes groundwork in mathematics and physical sciences, topical courses focused on diverse fields within astronomy and planetary science, and exposure to the engineering and computational tools and techniques used to carry out research.

4. **Contact and Support Information**

Building code and room number: *(Search ASU map)*	ISTB4 795
Program office telephone number: (*i.e. 480/965-2100*)	480/965-5081
Program Email Address:	SESE-advising@asu.edu
Program Website Address:	https://sese.asu.edu

5. **Delivery/Campus Information Options:** ASU Online only

   Note: Once students elect a campus or online option, students will not be able to move between the on-campus and the ASU Online options. Approval from the Office of the University Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online. Please contact Ed Plus then complete the ASU Online Offering form in Curriculum ChangeMaker to begin this request.

6. **Campus/Locations** *indicate **all** locations where this program will be offered.*

☐ Downtown Phoenix ☐ Polytechnic ☐ Tempe ☐ Thunderbird ☐ West ☐ Other: _____

7. **Additional Program Description Information**

A.	Additional program fee required for this program?	Yes
B.	Does this program have a second language requirement?	No

8. **Career Opportunities**
   Provide a brief description of career opportunities available for this degree program. (150 words maximum)

   Graduates will pursue careers in fields that value the quantitative, technical skills taught as part of an astronomy education. These include K-12 STEM teaching positions, science and technology journalism and writing careers, and technical careers involving statistical data analysis or computer programming or technical positions supporting space and research industry and policy.

9. **Additional Freshman Admission Requirements**
   If applicable, list any freshman admission requirements that are higher than and/or in addition to the university minimum undergraduate admission requirements.

   None

10. **Additional Transfer Admission Requirements**

If applicable, list any admission requirements for transfer students that are higher than and/or in addition to the university minimum undergraduate transfer admission requirements.

None

11. Change of Major Requirements

Standard change of major text is as follows: A current ASU student has no additional requirements for changing majors. Students should refer to https://students.asu.edu/changingmajors for information about how to change a major to this program.

If applicable, list any additional requirements for students who may change their major into this program.

None

12. Keywords

List all keywords used to search for this program (limit 10). Keywords should be specific to the proposed program.

Astronomy, Astrophysics, Planetary Science, Stars, Planets, Galaxies, Universe, STEM, Science, Space

13. Advising Committee Code

List the existing advising committee code to be associated with this degree.

Request for a new advising committee was submitted on 10-30-2019

Note: If a new advising committee needs to be created, please complete the following form:
Proposal to create an undergraduate advising committee

14. Change of Major E-mail Address

List the contact email address to direct students who are interested in changing to this major.

sese-advising@asu.edu

15. First Required Math Course

List the first math course required in the major map.

MAT 170

16. WUE Eligible

Has a request been submitted to the Provost by the Dean to consider this degree program as eligible for WUE?

No

Note: No action will be taken during the implementation process with regards to WUE until approval is received from the Provost.

17. Math Intensity

a. List the highest math course required on the major map. (This will not appear on Degree Search.)

MAT 210

b. What is the math intensity as indicated by the highest math required on the major map? Math intensity categorization can be found here: https://catalog.asu.edu/mathintensity

Moderate

18. ONET Codes

Identify ONET/SOC codes that should be displayed on Degree Search. ONET/SOC codes can be found at: http://www.onetonline.org/crosswalk/SOC/. Alternate titles displayed on Degree Search may vary and can be found at: https://catalog.asu.edu/alternate-career-titles.

25-2021.00	.....	43-9111.00	.....
25-2022.00	.....	27-3042.00	.....

25-2031.00		27-3022.00	
15-1131.00		27-3099.00	
15-1134.00			

19. Area(s) of Interest

A. Select **one (1)** primary area of interest from the list below that applies to this program.

- ☐ Architecture & Construction
- ☐ Arts
- ☐ Business
- ☐ Communications & Media
- ☐ Computing & Mathematics
- ☐ Education & Teaching
- ☐ Engineering & Technology
- ☐ Entrepreneurship
- ☐ Exploratory
- ☐ Health & Wellness
- ☐ Humanities
- ☐ Interdisciplinary Studies
- ☐ Law, Justice, & Public Service
- ☐ STEM
- ☒ Science
- ☐ Social and Behavioral Sciences
- ☐ Sustainability

B. Select **one (1)** secondary area of interest from the list below that applies to this program.

- ☐ Architecture & Construction
- ☐ Arts
- ☐ Business
- ☐ Communications & Media
- ☐ Computing & Mathematics
- ☐ Education & Teaching
- ☐ Engineering & Technology
- ☐ Entrepreneurship
- ☐ Exploratory
- ☐ Health & Wellness
- ☐ Humanities
- ☐ Interdisciplinary Studies
- ☐ Law, Justice, & Public Service
- ☒ STEM
- ☐ Science
- ☐ Social and Behavioral Sciences
- ☐ Sustainability

2020 - 2021 Major Map

Astronomical and Planetary Sciences, (Proposed)

School/College:
TUTJWJN

Term 1 - A 0 - 11 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes
AST 111: Introduction to Solar Systems Astronomy (SQ) AND AST 113: Astronomy Laboratory I (SQ)	4	C	• An SAT, ACT, Accuplacer, IELTS, or TOEFL score determines placement into first-year composition courses. • Mathematics Placement Assessment score determines placement into mathematics course. • ASU 101 or college-specific equivalent First-Year Seminar is required for all first-year students. • AST 111 and AST 113 are Session C courses (15 weeks long).
ASU 101-UC: The ASU Experience	1		
ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition	3	C	
MAT 170: Precalculus (MA)	3	C	
Term hours subtotal:	11		

Term 1 - B 11 - 17 Credit Hours	Hours	Minimum Grade	Notes
Social-Behavioral Sciences (SB) AND Global Awareness (G)	3		• View ASU Online first-year student registration information here.
Elective	3-2		
Term hours subtotal:	6-5		

Term 2 - A 17 - 27 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes
AST 112: Introduction to Stars, Galaxies, and Cosmology (SQ) AND AST 114: Astronomy Laboratory II (SQ)	4	C	• AST 112 and AST 114 are Session C courses (15 weeks long). • Select your career interest areas and play me3@ASU.
ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition	3	C	
MAT 210: Brief Calculus (MA)	3	C	
Term hours subtotal:	10		

Term 2 - B 27 - 33 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes
Humanities, Arts and Design (HU) AND Cultural Diversity in the U.S. (C)	3		
Elective	3-2		
Complete ENG 101 or ENG 105 or ENG 107 course(s)			
Term hours subtotal:	6-5		

Term 3 - A 33 - 40 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes
PHY 111: General Physics (SQ) AND PHY 113: General Physics Laboratory (SQ)	4	C	• Review the Career Guide for ASU Online Students to learn about available career planning resources.
Humanities, Arts and Design (HU)	3		
Term hours subtotal:	7		

Term 3 - B 40 - 47 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes

PHY 112: General Physics (SQ) AND PHY 114: General Physics Laboratory (SQ)	4	C
Science and Society Elective	3	C
Complete First-Year Composition requirement.		
Complete Mathematics (MA) requirement.		
Term hours subtotal:	7	

Term 4 - A 47 - 54 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes
SES 106: Habitable Worlds (SQ)	4	C	• Register for a Handshake account and participate in virtual career advising.
Social-Behavioral Sciences (SB) AND Historical Awareness (H)	3		
Term hours subtotal:	7		

Term 4 - B 54 - 60 Credit Hours	Hours	Minimum Grade	Notes
Computer/Statistics/Quantitative Applications (CS)	3		
Literacy and Critical Inquiry (L)	3		
Term hours subtotal:	6		

Term 5 - A 60 - 66 Credit Hours Necessary course signified by	Hours	Minimum Grade	Notes
AST 301: Physics of Astrophysics	3	C	• AST 301 is a Session C course (15 weeks long). • Build your professional connections -- join the ASU Mentor Network.
Elective	3		
Term hours subtotal:	6		

Term 5 - B 66 - 72 Credit Hours	Hours	Minimum Grade	Notes
Astronomical and Planetary Sciences Major Elective	3-4	C	• Major Elective options vary in credit hours. Depending on chosen courses, overall elective hours may vary.
Elective	3-2		
Term hours subtotal:	6		

Term 6 - A 72 - 78 Credit Hours Necessary course signified by	Hours	Minimum Grade	Notes
SES 350: Engineering Systems and Experimental Problem Solving	3	C	• SES 350 is a Session C course (15 weeks long). • Develop your professional online presence.
SES 376: Communicating Astronomical and Planetary Sciences I	3	C	
Term hours subtotal:	6		

Term 6 - B 78 - 84 Credit Hours Necessary course signified by	Hours	Minimum Grade	Notes
SES 377: Communicating Astronomical and Planetary Sciences II	3	C	• Use Handshake to research employment opportunities. • Major Elective options vary in credit hours. Depending on chosen courses, overall elective hours may vary.
Astronomical and Planetary Sciences Major Elective	3-4	C	
Complete Cultural Diversity in the U.S. (C) AND Global Awareness (G) AND Historical Awareness (H) course(s).			
Term hours subtotal:	6-7		

Term 7 - A 84 - 90 Credit Hours Necessary course signified by	Hours	Minimum Grade	Notes
AST 321: Introduction to Planetary and Stellar Astrophysics (SQ)	3	C	• AST 321 is a Session C course (15 weeks long). • Apply for full-time career opportunities.
Upper Division Science and Society Elective	3	C	

Term hours subtotal:	6

Term 7 - B 90 - 96 Credit Hours	Hours	Minimum Grade	Notes
Astronomical and Planetary Sciences Major Elective	3-4	C	• Major Elective options vary in credit hours. Depending on chosen courses, overall elective hours may vary.
Upper Division Literacy and Critical Inquiry (L)	3		
Term hours subtotal:	6-7		

Term 8 - A 96 - 102 Credit Hours Necessary course signified by ★	Hours	Minimum Grade	Notes
★ AST 322: Introduction to Galactic and Extragalactic Astrophysics (SQ)	3	C	• AST 322 is a Session C course (15 weeks long).
Upper Division Elective	3		
Term hours subtotal:	6		

Term 8 - B 102 - 108 Credit Hours	Hours	Minimum Grade	Notes
Upper Division Astronomical and Planetary Sciences Major Elective	3-4	C	• Major Elective options vary in credit hours. Depending on chosen courses, overall elective hours may vary.
Upper Division Elective	3-2		
Term hours subtotal:	6		

Term 9 - A 108 - 114 Credit Hours Necessary course signified by ★	Hours	Minimum Grade	Notes
★ Upper Division Astronomical and Planetary Sciences Major Elective	3	C	
Upper Division Humanities, Arts and Design (HU) OR Upper Division Social-Behavioral Sciences (SB)	3		
Term hours subtotal:	6		

Term 9 - B 114 - 120 Credit Hours	Hours	Minimum Grade	Notes
Complete 2 courses: Upper Division Elective	6		
Term hours subtotal:	6		

- All students pursuing a BS or BSP degree in The College of Liberal Arts and Sciences must complete two courses from the Science and Society list found at https://thecollege.asu.edu/resources/science-society. At least one of the two courses must be upper-division and students must earn a C or better in the courses. Both Science and Society courses (i.e., all 6 credits) may count towards any major, minor, related fields, and ASU General Studies requirements.

Hide Course List(s)/Track Group(s)

Astronomical and Planetary Sciences Major Electives	Upper Division Astronomical and Planetary Sciences Major Electives
BIO 181: General Biology I (SQ)	BIO 340: General Genetics
BIO 182: General Biology II (SG)	BIO 345: Evolution
BIO 340: General Genetics	MAT 343: Applied Linear Algebra
BIO 345: Evolution	MCO 307: The Digital Audience
CHM 113: General Chemistry I (SQ)	MCO 335: Social Media

CHM 114: General Chemistry for Engineers (SQ)

CHM 116: General Chemistry II (SQ)

GLG 101: Introduction to Geology I (Physical) (SQ)

GLG 103: Introduction to Geology I-Laboratory (SQ)

MAT 275: Modern Differential Equations (MA)

MAT 343: Applied Linear Algebra

MCO 307: The Digital Audience

MCO 335: Social Media

MCO 425: Digital Media Literacy I

PHI 314: Philosophy of Science (HU)

TWC 401: Fundamentals of Technical Communication (L)

TWC 446: Technical and Scientific Reports (L)

SES 141: Energy In Everyday Life (SQ)

STP 226: Elements of Statistics (CS)

MCO 425: Digital Media Literacy I

PHI 314: Philosophy of Science (HU)

TWC 401: Fundamentals of Technical Communication (L)

TWC 446: Technical and Scientific Reports (L)

Notes:

- Please keep in mind that the applicability of a specific transfer course toward an ASU degree program depends on the requirements of the department, division, college or school in which you are enrolled at ASU. Transfer agreements that guarantee the completion of university level requirements do not necessarily meet college and major requirements. Please consult with an advisor for more information.

Total Hours: 120
Upper Division Hours: 45 minimum
Major GPA: 2.00 minimum
Cumulative GPA: 2.00 minimum
Total hrs at ASU: 30 minimum
Hrs Resident Credit for Academic Recognition: 56 minimum
Total Community College Hrs: 64 maximum
Total College Residency Hrs: 12 minimum

General University Requirements Legend

General Studies Core Requirements:

- Literacy and Critical Inquiry (L)
- Mathematical Studies (MA)
- Computer/Statistics/Quantitative Applications (CS)
- Humanities, Arts and Design (HU)
- Social-Behavioral Sciences (SB)
- Natural Science - Quantitative (SQ)
- Natural Science - General (SG)

General Studies Awareness Requirements:

- Cultural Diversity in the U.S. (C)
- Global Awareness (G)
- Historical Awareness (H)

First-Year Composition

BS in Astronomical and Planetary Sciences

Status:UOEEE Provisional Approval

Comments: UOEEE Provisional Approval

Element	Outcome	Measure	Description
AP_2Goal	0		
Outcome	1	0	Graduates of the program will be able to apply astronomical concepts and principles of physical science to articulate, discuss and explicate core disciplinary concepts in astronomy and planetary sciences.
Plan_1GenEd	1		Creative Thinking;Critical Thinking;Inquiry and Analysis;Problem Solving;Quantitative Reasoning/Literacy;Verbal Communication;Written Communication;
Plan_2Concepts	1		Students will apply physical laws and problem-solving skills to integrate observations and theoretical concepts in astronomical and planetary sciences. Students will apply computer programming and modeling skills to scientific problems. Students will communicate elements of theoretical concepts and supporting observations.
Plan_3Competencies	1		Students will be able to demonstrate skills in scientific problem solving, communicating observations and theoretical concepts in astronomical and planetary sciences, computer programming, and computer and mathematical modeling.
AP_1Process	1	1	Faculty in AST 112 will design a rubric for the course final exam. Faculty in AST 321 will design rubrics for course work and project. Faculty in AST 322 will design rubric for course work.
Measure	1	1	In AST 112, Introduction to the Stars, Galaxies and Cosmology, students will build upon core skills from AST 111 and basic principles of cosmology to integrate observations regarding the structure and evolution of stars, star clusters, and galaxies.
PC	1	1	75% or more students will score satisfactory or above on a faculty designed rubric applied to the course final exam.
Measure	1	2	In AST 321 Stellar and Planetary Astrophysics, students apply physical laws to explore the properties and evolution of stars and planets in assignments and a guided research project using introductory computer programming.
PC	1	2	75% of students will score satisfactory or above on a faculty designed rubric which includes quantitative literacy and the ability to clearly communicate elements of theoretical concepts and supporting observations.
Measure	1	3	In AST 322 Galactic and Extragalactic Astrophysics, students will apply computer and mathematical modeling to work in relativity, cosmology, and the structure and dynamics of galaxies and the interstellar medium.
PC	1	3	75% of students will score satisfactory' or above on a faculty designed rubric evaluating the applicability of tools applied and accuracy of modeling.

Element	Outcome	Measure	Description
Outcome	2	0	Graduates of the program will be able to manage, evaluate, and interpret datasets to solve quantitative problems and test hypotheses within an astronomical context utilizing modern computing methods
Plan_1GenEd	2		Creative Thinking;Critical Thinking;Information Literacy;Inquiry and Analysis;Problem Solving;Quantitative Reasoning/Literacy;Teamwork and Collaboration;Written Communication;
Plan_2Concepts	2		Students will apply computer programming and modeling skills to scientific problems. Students will interpret datasets using modern computing methods. Students will use principles of scientific investigation and teamwork to design experiments with appropriate computational methods.
Plan_3Competencies	2		Students will be able to demonstrate skills in scientific method, designing experiments and choosing appropriate computational methods to interpret datasets, scientific problem solving, computer programming (e.g, Python), and computer and mathematical modeling.
AP_1Process	2	1	Faculty in SES 350 will design a rubric for course work and projects.
Measure	2	1	In SES 350 Engineering Systems and Experimental Problem Solving, student teams will use the scientific method to design experiments that generate data informing conceptual approaches and potential obstacles to development solutions for assigned projects.
PC	2	1	75% of students will score satisfactory or above on a faculty-designed rubric that includes assessment of knowledge of engineering systems and use of deductive reasoning.
Measure	2	2	In SES 350 Engineering Systems and Experimental Problem Solving, students will employ computational tools to solve assigned problems by developing software in an interpreted language (e.g. Python).
PC	2	2	75% of students will score satisfactory or above on a faculty designed rubric assessing progress in the application of computational tools.

Element	Outcome	Measure	Description
Outcome	3	0	Graduates of the program will demonstrate the ability to work collaboratively in interdisciplinary groups to solve scientific problems and to do so within the ethical frameworks of sciences and the discipline of astronomy.
Plan_1GenEd	3		Creative Thinking;Critical Thinking;Information Literacy;Inquiry and Analysis;Problem Solving;Quantitative Reasoning/Literacy;Teamwork and Collaboration;Verbal Communication;Written Communication;
Plan_2Concepts	3		Students will use principles of scientific investigation and teamwork to design experiments with appropriate computational methods. Students will develop a research question. Students will use collaboration, communication skills, and civil discourse within a student team to design a solution to a research question and discuss the impact of these as they arise.
Plan_3Competencies	3		Students will be able to demonstrate skills in scientific inquiry, designing ethical experiments and choosing appropriate computational methods to interpret datasets, integrating core and advanced theory and methods into a team project, collaborating and communicating within a team of students, assigning tasks between team members, and problem solving.
AP_1Process	3	1	Faculty in SES 350 will design a rubric for course work and projects.
Measure	3	1	In SES350, Engineering Systems and Experimental Problem Solving, students will develop a research question or proposal for a design project using skills and knowledge gained in progressive course work. The proposal would prepare students to engage with important scientific agencies, governmental and non-governmental institutions and funding sources for the work (for example, NASA, the National Science Foundation, industry partners, etc.)
PC	3	1	75% of students will score satisfactory or above on a faculty designed rubric that measures integration of core and advanced theory and methods in the astronomical and planetary sciences in the work product.
Measure	3	2	In SES350, Engineering Systems and Experimental Problem Solving teams of students will employ collaborative and communication skills to critically assess project needs, assign tasks to individual members to create a successful design solution.
PC	3	2	75% of students will score satisfactory or above on a faculty developed rubric of professional standards in group communication, civil discourse, information literacy, and ethical problem solving.

If you have questions, please e-mail assessment@asu.edu or call UOEEE at (480) 727-1731.

MEMORANDUM

To: Gemma Garcia
From: Carolyn Culley
Date: 1/8/2020
Subject: Bachelor of Science in Astronomical and Planetary Sciences

Dear Gemma,

Congratulations!

The Bachelor of Science in Astronomical and Planetary Sciences program has received support from Dean Phil Regier to be offered through ASU Online. This program must complete university governance reviews for formal approval. Please include this support memo along with your proposal submission when it is submitted formally to the university (to curriculumplanning@asu.edu) by your dean or their designee.

Please note that in order to proceed with implementation, final approval must be supplied by the university provost.

Once again, congratulations! We are excited to work with you on your new program.

Thank you!

Carolyn Culley

Associate Director, Academic Program Management
EdPlus at ASU
Arizona State University
Phone: (480) 884-0156
Carolyn.Culley@asu.edu

CC: CurriculumPlanning@asu.edu