



Executive Memorandum 23-009

May 22, 2023

From: Gayle E. Hutchinson, President

A handwritten signature in blue ink that reads "Gayle E. Hutchinson".

Subject: Approval of the new minor in Astronomy

Upon the recommendation of the Academic Senate and with the concurrence of the Provost, I approve the new minor in Astronomy.

Policy Title:	EM 23-009 Approval of the new minor in Astronomy
Contact:	Department of Physics
Supersedes:	
Revision:	
Enabling Legislation or Executive Order:	

New Minor Signature Form

Minor Name: Astronomy

Department Contact(s) w/phone #(s):
Dr. Eric Ayars, Chair of Physics, (530) 898-6967

Required Signatures

The Department of Physics
has reviewed and approved this new minor

Kendall P. Hall Jan 6, 2023
Kendall.Hall-Chair, Dept. Curriculum Committee Date

Eric Ayars Jan 7, 2023
Eric.Ayars-Department Chair Date

The College of Natural Sciences
has reviewed and approved this new minor

Jinsong Zhang Jan 7, 2023
Jinsong Zhang-Chair, College Curriculum Committee Date

David M. Hassenzahl Jan 9, 2023
David M. Hassenzahl - College Dean Date

Send signature page with proposal attached to Curriculum Services at zip 128

Curriculum Review Completed _____
Date

Note: The department will be notified of the dates for EPPC and Academic Senate review.

Astronomy Minor

Addendum

- **Direct cost of the minor:** At most 6 WTU per year, less once all factors are considered. All but two of the courses for this minor existed previously and are taught every semester. Only two courses are new: PHYS 361 and PHYS 365, which will be taught on alternating semesters to maximize enrollment and minimize total cost. The two new courses (PHYS 361/365) are already approved and are being offered for the 23/24 school year, independent of the astronomy minor. The cost of those courses will be partially offset by the students who take these two courses in addition to the courses they would take otherwise, and further offset by the additional students taking other courses in the pre-existing astronomy minor curriculum.
- **Indirect cost of the minor:** Zero.
The proposed minor requires no additional staff, equipment, training, release time, field trip expenses, or anything else. It uses existing resources and local expertise.
- **How this minor prepares students for success in the global economy:** It provides an accessible route to improved scientific literacy.
Far too many of our students arrive on this campus unprepared for a science major, even if they had the interest in pursuing science as a major in the first place. This is particularly problematic for many of our URM students and students from poorer school districts. These students certainly have the ability to benefit from scientific literacy, frequently have the desire to study science, and *scientific literacy vastly improves their odds of success in today's economy*. But through no fault of their own they and their families lack the resources to take the extra semesters of mathematics, for example, that would be required for a science major. This minor allows them to pursue scientific study that they could not otherwise.

Proposal for a New Minor

- I. *Proposed title of new minor.*
Minor in Astronomy
- II. *Academic year of intended implementation.*
2023-2024 (or following year if '23-'24 is not realistic.)
- III. *Name of the department and college submitting the proposal; identify unit with primary responsibility for the minor.*
College of Natural Sciences, Department of Physics
- IV. *Statements on questions of need and demand.*
 - A. *Relation of the minor to the [University Strategic Plan](#).*
 - Historically, students of Latinx heritage are underrepresented in the hard sciences, particularly Physics. The Department of Physics is already challenging this underrepresentation with our outstanding success at attracting –and graduating– Latinx physics students. But that success, impressive as it may be, is masking a larger problem. Far too many of our historically underserved students arrive on campus unprepared mathematically for studies in physical science. They may have the interest, even the strong desire, to study physical science but the extra year or more of math that would be required just to *start* a degree in Physics forces them into other majors. By building this Astronomy minor around a less mathematically-intensive course sequence, we are providing students the opportunity to study science without the extra year(s) in college that would otherwise be required. This aspect of the Astronomy minor is targeted directly at the first of the Strategic Priorities in the Plan: Equity, Diversity, and Inclusion: We recognize that historically underserved students have not had equal access or opportunity for educational success. This minor provides these students low-barrier access to meaningful study in the very first of the sciences, Astronomy.
 - The Astronomy minor also addresses the issue of Academic Distinction. One of the Enduring Commitments in the Strategic Plan is to deliver interdisciplinary experiences that prepare students for success in the global economy and develop the collaborative and critical thinking skills to solve the challenges of the future. By designing this minor to be accessible to majors outside of science and engineering, we are specifically addressing the need for accessible interdisciplinary experiences for our students. This minor opens a door to training in hard-science critical thinking skills that would otherwise not be available to students in majors outside of those sciences. As one specific example, students taking the required courses for a degree in Kinesiology would already be halfway to completion of this Astronomy minor. This is just an example; but it's an example that shows the breadth of opportunity opened to students by this minor.

B. *Need for the proposed minor.*

Astronomy is *interesting*. Students want to learn about it. Polling of 220 students in 200-level courses in the Physics department indicate that 44% of the students would be somewhat/very/extremely interested in adding such a minor. Many of those students were seniors: a second question addressing level of interested if the major had existed when they started classes at Chico State came in at 58% for the same levels of interest, with 16% “extremely interested”.

As far as we can determine, only four of the 23 CSU campuses currently offer a minor in Astronomy. Addition of this minor to Chico State will increase our competitiveness with respect to other CSU campuses (and other universities) that do not offer students the opportunity to study this interesting subject.

C. *Identify other closely related curricula currently offered by the campus.*

There are no other closely related curricula on this campus.

1. *Explain the impact the proposed minor will have on these programs.*

The only program with content close to that of this minor is the Minor in Physics. However, these two minors are tailored to meet the needs and interests of two different student populations. The Minor in Physics requires Calculus, PHYS 204A/B/C, and Modern Physics, and attracts students primarily from Engineering, Chemistry, and Mathematics. The proposed Minor in Astronomy will not require Calculus, and is expected to attract the majority of its students from majors that require the Algebra-based PHYS 202 sequence. We have designed the Astronomy minor so as to minimize the additional course load for these students, making it an easy addition for those students interested.

2. *Explain how current programs do not meet the proposed minor's objectives.*

There is significant public interest in the field of Astronomy. Programs such as the newly-launched James Webb Space Telescope, the revival of manned Lunar missions, and private efforts such as Space-X and Blue Origin all increase curiosity and interest in things outside the thin shell of this planet's atmosphere; yet there is no program on this campus that talks about astronomy at all. There are astronomy minors on at least four other CSU campuses; let's give students the option of satisfying that intellectual curiosity *here*.

D. *Student demand for the minor.*

We have surveyed 220 students in multiple sections of PHYS 202A through 204C. Results are extremely positive, with 16% of respondents stating that they would have been ‘extremely interested’ in this minor had it been available at the start of their studies at Chico. The students responding to the survey were only those in a physics class already, so

there is some selection bias in the data; but the students responding were also *required* to take physics and the vast majority of students on campus are not so required. It's not completely clear-cut data, but it seems very likely that we will be able to fill the classes involved without difficulty.

V. *Resources*

A. *List the faculty members for the required courses in the minor by Name*

Rank

Appointment status

Highest degree earned

Date and Field of highest degree

Professional experience

1. Dr. Kendall Hall, Assistant Professor of Physics
Ph.D in Astrophysics, 2020. More than a year of teaching experience at CSU Chico. Continuing active research in Astrophysics.
2. Dr. Kevin McLin, Lecturer in Physics, Ph.D in Astrophysics, 2001. 20+ years teaching experience in both physics and astronomy courses. Author of an Astronomy textbook. Director of the Global Telescope Network for NASA's Fermi EPO Program. Author of numerous NASA Teaching and Learning Guides. Instructor for NASA Astrophysics Ambassador Program Teacher Training Institute. (Etc.)
3. Dr. Nicholas Nelson, Associate Professor in Physics, Ph.D in Astrophysics, 2013. Eight years teaching experience at CSU Chico. Continuing active research in Astrophysics.

B. *List the faculty members for the elective courses in the minor by Name*

Rank

Appointment status

Highest degree earned

Not applicable, there are no electives in this Minor at present.

C. *List the resources needed to sustain the program for the first five years, including cost and funding source.*

1. *Faculty*

The Department of Physics has faculty with the necessary areas of expertise to support this minor *already*. Indeed, this is why we're pursuing it: we want to better utilize our existing faculty resources and expertise.

2. *Staff*

No additional staff needs are expected.

3. *Facilities*

- a. Existing classroom and lab facilities in SCI are sufficient for the in-class needs of this minor.
- b. The Chico Community Observatory has agreed to partner with us to provide viewing space for astronomy viewings

(expected for PHYS 361, CPRC previously submitted. See letter of support from CCO.)

- c. Additionally, the operators of the remote-controlled observatory at Sonoma State have agreed to allow us some use of their facility. (See letter of support from Sonoma State.)

- 4. *Library resources; provide evidence of consultation with the Library Dean indicating that the program can be supported by the library.*

See letter of support from Marc Langston.

- 5. *Equipment*

The Department of Physics expects to need minimal equipment in support of this minor for the first five years. Existing resources in the department are sufficient.

Should the program really take off, it may be advantageous to add an observational lab component to the program. That would be a nice problem to have, someday, but for now we have designed the program to fit within existing equipment availability.

- 6. *Specialized material*

None.

- D. *Additional support resources required, including source of support.*

None. It is worth re-emphasizing here that this minor is designed to more effectively utilize our *existing* resources, rather than seek out more resources. We know there are tight financial times coming, and we've built this proposed minor with those times in mind.

VI. *Curriculum*

Note: Proposed curriculum should take advantage of courses already offered in other departments when subject matter would otherwise overlap or duplicate existing course content.

- A. *Total number of units required for the minor (maximum 30 units of which at least 6 will be upper-division).*

24 units.

- B. *List all new courses for the proposed program.*

- 1. *Course number and title*

Units of credit

Prerequisites

Proposed catalog description

Mode of course delivery if other than regular

- a. Astronomy: Stars and Telescopes, PHYS 361

3 units

Prerequisites: PHYS 100, PHYS 202A, PHYS 202B

Description: Fundamentals of modern astronomy including the Sun; stellar structure; evolution of stars from formation to stellar remnants; white dwarfs, neutron stars, pulsars, and black holes; novae and supernovae; modern telescopes

from radio to gamma rays; hands- on experience with optical observations; analysis and interpretation of stellar data. 2 hours discussion, 2 hours activity

- b. Astronomy: Galaxies and Cosmology, PHYS 365
3 units

Prerequisites: PHYS 361

Description: Current theoretical and observational understanding of galaxies, including the Milky Way, and cosmology. Galaxy formation, structure, and evolution are covered in the context of our wider cosmological understanding of the universe as a whole. Observational and theoretical underpinnings for our current model of cosmology, the Hot Big Bang, as well as the effects of dark matter and dark energy, will be discussed in detail. 3 hours lecture.

2. *Identify the new courses needed to initiate the program.*
PHYS 361, PHYS 365 (see above.)
3. *Identify the new courses needed during the first two years after implementation.*

No additional new courses beyond PHYS 361 and PHYS 365.

- C. *List all required courses for the minor along with a rationale for why each one should be required. If applicable, you can refer to the proposal's or program's learning outcomes.*

Course number and title

Units of credit

Prerequisites

Rationale

1. PHYS 100, Intro to Astronomy, 3 units
No prerequisites
PHYS 100 exists already as a large GE course. It covers the basic overview of Astronomy at a level appropriate for this minor.
2. CHEM 107 (or CHEM 111), 4 units
Prerequisites: GE Mathematics/Quantitative Reasoning Ready, Intermediate Algebra.
CHEM 107 provides the basic understanding of chemistry and chemical energies necessary for understanding Astronomy.
Inclusion of this course has been discussed with the Chair of Chemistry, see attached letter of support.
3. PHYS 202A General Physics I, 4 units
Prerequisites: High school Physics, Trigonometry, and Algebra II or MATH 118 or co-enrollment in PHYS 102.
PHYS 202A/B covers the physics necessary for understanding Astronomy at a level appropriate for this minor.
4. PHYS 202B General Physics II, 4 units
Prerequisite: PHYS 202A

PHYS 202A/B covers the physics necessary for understanding Astronomy at a level appropriate for this minor.

5. EARTH 203, Principles of Historical Geology, 3 units
Prerequisites: EARTH 102 or EARTH 103 (or PHYS 202A/B waiver, see letter from Chair of EARTH.)
EARTH 203 serves as the 'Planetary Astronomy' course for this minor. It covers planetary formation, planetary geology, etc. We have consulted with the Chair of Earth and Environmental Sciences regarding inclusion of this course in the minor, see attached letter of support.
6. PHYS 361, Astronomy – Stars & Telescopes, 3 units
Prerequisites: PHYS 202A/B
PHYS 361 covers the 'small stuff' in Astronomy; small stuff such as stars, solar systems, supernovae, etc.
7. PHYS 365, Astronomy – Galaxies and Cosmology, 3 units
Prerequisite: PHYS 361
PHYS 365 covers the 'big stuff' in Astronomy. Galaxies, galaxy clusters, the big bang, etc.

- D. *List all elective courses for the minor along with a general rationale for why each should be included as such. If applicable, you can refer to the proposal's or program's learning outcomes.*
Course number and title
Units of credit
Rationale
This minor has no electives as proposed.
- E. *Explain provisions for articulation of the proposed minor with community college courses.*
Existing articulation agreements with community colleges cover most of the lower-division material for this minor. PHYS 100 articulates with any existing "Intro to Astronomy" course at the community college level. CHEM 107 articulates with "Intro Chemistry", and PHYS 202A/B articulates with the equivalent algebra-based General Physics courses. A student transferring from community college could arrive at Chico State already having completed 15 of the 24 units for this minor.
- F. *Complete catalog copy, including admission and completion requirements. See the current University Catalog for correct format; please follow it exactly. Before the proposal is submitted to Curriculum Services, it may be helpful to review catalog copy with Academic Publications.*
See attachments "Astronomy catalog Overview" and "Astronomy catalog Program Requirements".

Attach the [New Minor signature form](#) to the front of the proposal and submit to Curriculum Services after all department and college reviews are complete.

Astronomy Minor

Total Units Required: 24

- [Overview](#)
- [Program Requirements](#)

The Minor in Astronomy offers space in the sciences for students of any major. It provides a lens with which students from a broad spectrum of majors can apply scientific thought to their chosen orbit of study. For students already majoring in science it provides an additional focus on the first of all the sciences. It will take students to far horizons, regardless of the planned trajectory of their career.

Astronomy Minor

Total Units Required: 24

- [Overview](#)
- [Program Requirements](#)

Course Requirements for the Minor

The following courses, or their approved transfer equivalents, are required of all candidates for this minor.

Course	Course List Title	Units
PHYS 100	Introduction to Astronomy: Survey of the Cosmos	3
CHEM 107	General Chemistry for Applied Sciences	4
PHYS 202A	General Physics I	4
PHYS 202B	General Physics II	4
ERTH 203	Principles of Historical Geology	3
PHYS 361	Astronomy – Stars & Telescopes	3
PHYS 365	Astronomy – Galaxies & Cosmology	3
Total Units		24

From: Christopher J Nichols CJNichols@csuchico.edu
Subject: Letter of Support, Astronomy Minor
Date: October 17, 2022 at 10:27 AM
To: Eric Ayars EAYars@csuchico.edu



Dear EPPC, Academic Senate, and to whom it may concern

Prof. Ayars, Chair of the Department of Physics, shared with me his plans for the Minor in Astronomy, which would include either completion of CHEM 107 or CHEM 111. The Department of Chemistry and Biochemistry will certainly be able to accommodate any increase in enrollment in these courses from students adding this minor to their program.

The Department of Chemistry and Biochemistry supports the addition of this minor and commends the Department of Physics for putting together a minor which will attract interest from students, including those whose primary area of study is not science or technology.

Thanks
cjn

Christopher J. Nichols
Professor and Chair
Department of Chemistry and Biochemistry
CSU, Chico
400. W. 1st Street
Chico, CA 95929-0210
(530) 898-5290

Department of Earth and Environmental Sciences
California State University, Chico
400 West First Street
Chico, California 95929-0205



September 29, 2022

Department Chair Dr. Eric Ayars:

As Chair of the Department of Earth and Environmental Sciences (ERTH), I am writing to offer my support of the proposed Astronomy Minor within the Physics Department. ERTH is prepared to include ERTH 203 (Historical Geology) as a required course for the minor, as well as other resources that are deemed appropriate for support. We are also willing to waive the ERTH 101/102 as a prerequisite for ERTH 203. As the Minor grows, we are also willing to have other ERTH courses as potential candidates to help support the curriculum as well.

Sincerely,

A handwritten signature in black ink, appearing to read "Todd J. Greene".

Todd J. Greene
Professor and Chair

Todd J. Greene, Professor and Chair, Department of Earth and Environmental Sciences
CSU Chico • 400 W 1st St., Chico, CA 95929-0205 • www.csuchico.edu/erth
Office: 530.898.5546 • E-mail: tjgreene@csuchico.edu

Meriam Library
California State University, Chico

--

MEMORANDUM

To: Dr. Eric Ayars

From: Marc Langston

Date: September 30, 2022

Subject: Library materials support for Physics program changes, specifically the new Astronomy minor

Library materials appropriate for the proposed Astronomy minor are classified under the Library of Congress classifications of QB-Astronomy. Library materials currently held by the library in this subject area are listed below:

Print Books: 1,506 titles

Print journals: 39 titles

E-books: 728 titles

E-journals: 87 titles

Databases: Academic Search, American Physical Society, American Institute of Physics, Science Direct, Wiley Online Library, JSTOR, Oxford Journals, SpringerLink

In addition to resources currently held in the Library, Physics is allotted an annual book budget to purchase new library materials. Selection of these new materials is overseen by the Library's Physics Librarian, who also makes available information literacy instruction for all Physics classes.

The Meriam Library currently provides adequate access to both electronic and physical library and learning resources that would support the new Astronomy minor.

Lynn Cominsky

lynnc@universe.sonoma.edu

707.664.2655



EdEon at Sonoma State University, 1801 E. Cotati Ave., Rohnert Park, CA 94928



Prof. Eric Ayars
Physics Department
CSU Chico

September 26, 2022

Dear Dr. Ayars,

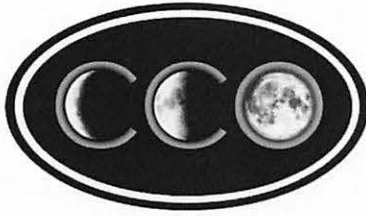
This letter is to affirm that the EdEon group at Sonoma State University agrees to offer time, on an occasional basis, using our remote/robotic telescope GORT, to students in the proposed astronomy minor at Chico State University. This offer is made with the understanding that time will be provided as scheduling allows, and that GORT is not to be the primary observing facility for students at Chico State. There will be no charges incurred or payable due to the use of GORT by Chico State students.

Please direct any questions to Dr. Lynn Cominsky (lynnc@universe.sonoma.edu) or Dr. Laura Peticolas (larap@universe.sonoma.edu) at EdEon STEM Learning, Sonoma State University.

Sincerely,

A handwritten signature in blue ink that reads "Lynn R. Cominsky".

Lynn R. Cominsky
Professor, Department of Physics & Astronomy
Director, EdEon STEM Learning



**CHICO COMMUNITY
OBSERVATORY**

1 Observatory Way
Chico, CA 95926

Ph: (530) 487- 4071

Email: chicoobservatory@gmail.com

Website: <http://www.facebook.com/ChicoCommunityObservatory>

September 30, 2022

Dear Committee Members,

I am writing this letter in support of the proposed Astronomy minor degree program in the department of Physics at California State University, Chico. The Chico Community Observatory (CCO) has been a part of the Chico community since 2001, and we are excited to build a closer relationship to the university, the Department of Physics, and to its faculty and students.

CCO is a 501(c)(3) non-profit corporation, and is organized and run entirely on volunteer effort. Several of our prior docents have been students at Chico State, and have gone on to earn their PhDs in Astronomy and Astrophysics at other institutions. We would like to think that our work there has far reaching consequences that go well beyond the border of our city.

The observatory would like to offer the use of our facility and equipment on days and evenings that we are not open to the general public, and in return we hope to encourage a new generation of Chico State students to develop their interest in astronomy, and potentially become observatory volunteers. The collaboration would be beneficial to everyone involved.

Sincerely,

William Koperwhats
Director, Chico Community Observatory