Beneath southern stars: Reflections on science, culture, and transformation in Chile

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Abstract

Chile: Southern Stars is an interdisciplinary study abroad program jointly offered by Juniata College's Departments of Physics and World Languages and Cultures. Designed around the Forum on Education Abroad's Standards of Good Practice, it integrates observational astronomy with Chilean cultural, historical, and literary studies. Students prepare through a semester of academic coursework before a two-week field immersion across Chile, visiting sites such as the Atacama Large Millimeter/submillimeter Array, Cerro Tololo Observatory, Gabriela Mistral Museum, and Humboldt Penguin Reserve. Fieldbased learning includes micro-expertise presentations, guided telescope observations, and reflective journals linking celestial phenomena to cultural narratives. Topics span indigenous cosmologies, resource politics, environmental conservation, and poetic representations of the cosmos. Emphasizing ethical engagement, inclusive pedagogy, and integrative reflection, the program fosters disciplinary knowledge, intercultural competence, and personal growth. Chile: Southern Stars demonstrates how place-based, interdisciplinary design can unite science and the humanities in transformative global education.

Keywords

Astronomy and culture; Chilean studies; experiential education; global citizenship; interdisciplinary learning

Chile: Southern Stars is a multidisciplinary study abroad program rooted in the collaboration between the Departments of Physics and World Languages and Cultures at Juniata College, a private liberal arts institution in Huntingdon,

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PA. Co-led by Dr. Matthew Beaky and Dr. Amy Frazier-Yoder, the course was developed to connect scientific and humanistic inquiry through astronomy and Chilean culture. The program begins with a semester-long academic preparation course in the fall and concludes with a two-week field experience in Chile during winter break. It is intentionally designed to provide students with deep, hands-on learning that links celestial observation to the cultural, historical, literary, and political aspects of life in Chile. The course, which has won the 2026 Award for Excellence in Education Abroad Curriculum Design, is profiled in Table (1) below.

TABLE (1)

COURSE PROFILE

Course or Program Title and Numbers	Fall 2024: AS300: Chile: Southern Stars Winter 2025: AS301: Chile: Southern Stars (travel portion)
Course or Program Title	Chile: Southern Stars
Target Student Population(s)	None
Content Focus, Field, or Discipline	Astronomy; Chilean culture
Credit-Bearing	Yes
Program Level	Undergraduate
Program Duration	Short-term (two weeks)
Onsite Locations	Chile – various sites

This design directly supports the Forum on Education Abroad's Standard 3: Academic Framework, which calls for programs to offer structured, rigorous, and integrated academic content rooted in the local context. The program's interdisciplinary learning objectives reflect its ambition for students to gain proficiency in observational astronomy, distinguishing celestial bodies, applying the celestial sphere model, and using telescopes and star maps, while also developing cultural literacy through literature, film, and historical analysis. Course assessments include critical response essays, micro-expertise presentations, and a two-part interdisciplinary final paper which incorporates student cultural observations.

The pre-departure semester builds a foundation for this integration which aligns with Standard 2: Student Learning and Development. Readings from The Chile Reader, films, and lectures prepare students to engage with

topics such as indigenous cosmologies, post-dictatorship memory, and ecological conservation. These foundations are reinforced on-site through intentionally planned excursions. For example, a hike in Valle de Arcoíris (Rainbow Valley) prompts discussion of geologic processes and indigenous land stewardship, while petroglyphs at Yerbas Buenas connect ancient astronomical knowledge to modern sky-watching.

One of the most unique features of Chile: Southern Stars is how it balances science and the humanities in an international setting. Few education abroad programs equally weigh astrophysics and cultural studies. Yet here students link, for example, the observation of the Magellanic Clouds in the night sky with Mapuche cosmologies and Neruda's metaphors for the infinite. This deliberate interdisciplinarity addresses Standard 3.6, which requires both disciplinary depth and accessibility for learners from diverse academic backgrounds.

The winter break component of the course exemplifies the integration of academic and experiential learning. Early in the trip, students visit the Atacama Large Millimeter/submillimeter Array (ALMA), one of the world's most advanced astronomical observatories, located 5,000 meters above sea level. Here, they relate what they have learned in theory to practice by exploring interferometry and its role in key discoveries, such as the imaging of a supermassive black hole in 2019. Later, practical telescope sessions in the Elqui Valley let students apply their skills with star maps and binoculars in some of the clearest night skies on the planet.

Engagement with place is central to the course design. Chile serves as a living classroom with its geography and history shaping the curriculum. Visits to Cerro Tololo Inter-American Observatory and Gemini South Observatory complement learning at Humboldt Penguin National Reserve, where marine biodiversity illustrates the interconnectedness of oceanic and cosmic cycles. In Parque Nacional Fray Jorge, students study a rare fog-fed rainforest thriving in a semiarid climate, making connections to moisture patterns that are important for astronomical observations.

Cultural and historical depth develops through thorough engagement alongside scientific topics. While examining Pablo Neruda's odes about the cosmos, students tour La Sebastiana, his home in Valparaíso. Here, they reflect on how place and history enrich poetic imagination. Similarly, a visit to the Gabriela Mistral Museum in Vicuña allows students to relate Mistral's literary depictions of the Andean landscape to their own experiences.

Pedagogy further deepens this integration. The micro-expertise presentations are a highlight, allowing peers to serve as co-educators. One presentation covers the War of the Pacific, situating Chile's historic nitrate

mining within current resource politics. Another discusses the clothing dump in the Atacama Desert and the environmental impact of the global fast-fashion industry. Assignments are crafted to foster reflection and synthesis, adhering to Standard 3.8. Journals, which account for 35% of the travel component grade, require students to record immediate thoughts on topics from national identity to advancements in astronomy. One student's journal, written during a visit to the salt flats of the Atacama Desert, considers the coexistence of flamingos with industrial lithium mining, weighing the ecological costs driven by global battery demand. Another student reflects on adjusting to water scarcity while traveling and how it relates to the legacy of Chile's 1981 Water Code.

Inclusive teaching methods throughout the program ensure diverse perspectives. Assigned readings feature various Chilean voices, including those of indigenous peoples, feminists, the working class, and exiles, so students encounter a wide range of narratives. Group agreements and shared leadership between instructors create an environment where all students feel encouraged to participate. These efforts align with Standard 1: Mission and Goals and Standard 6: Policies and Procedures, promoting fairness and responsible engagement.

Ethics and integrity (Standard 9) are emphasized throughout the course. During visits to lithium and copper mining sites, students explore the views of local Atacameño communities amid global sustainability discussions. The ethics of astronomy also come into play as students learn about ALMA's international governance and scientists' responsibilities in preserving dark skies against urban light pollution. Cultural visits, whether to colonial churches that blend Spanish and indigenous architectural styles or pisco distilleries that showcase centuries of agricultural changes, encourage reflection on the preservation and commercialization of heritage. These conversations raise awareness of positionality, reminding students that both cultural and scientific endeavors carry obligations to host communities and the environment.

The program's pacing is designed to balance intensity with reflection. In San Pedro de Atacama, days begin with fieldwork at Laguna Chaxa, observing flamingos' specialized feeding adaptations, followed by an afternoon at Termas de Puritama for restorative immersion in thermal pools. Nights often conclude with stargazing, connecting ecological observations to celestial mechanics overhead. In Pisco Elqui, the UFO walk invites playful curiosity about sky phenomena, while in Vicuña, a scavenger hunt through local markets builds familiarity with community spaces.

Health, safety, and preparation are woven into the academic design, reflecting Standards 4, 5, and 8. Homestays in La Serena require adaptability and intercultural communication, while safety briefings, such as guidelines for

avoiding petty theft in urban areas, prepare students to navigate respectfully. Environmental service learning, communal meals, and collaborative cooking embed students within local rhythms of life. Logistical considerations, from avoiding arsenic-contaminated water in northern towns to emphasizing hydration and sun protection at high altitudes, model best practices in field-based study abroad.

Learning continues well beyond the return home. Final papers are revised after returning to the U.S and uploaded to digital portfolios with an added reflection on how field experiences shifted students' perspectives. Portfolios serve both as an assessment tool (Standard 7) and as a professional artifact for future opportunities. Faculty use student reflections and anonymous evaluations to make programmatic improvements each year. Past cohorts have seen their program work evolve into senior theses or public presentations on topics like Chile's move to solar energy or indigenous land stewardship in astronomy tourism.

Ultimately, Chile: Southern Stars is more than a course, it is a transformative encounter. Students are encouraged to look both upward and inward, exploring new worlds while questioning their place within them. The blend of scientific rigor and cultural immersion not only exemplifies the Forum's Standards of Good Practice but also reflects Juniata College's mission to combine global engagement, academic excellence, and inclusive learning. From the fog-fed forests of Fray Jorge to the silver mirrors of Gemini South, from the salt flats of the Atacama to Neruda's poetry, the program creates a constellation of experiences that guide students long after they leave Chile.

List of Supplemental Materials

Suppl. 1: Course Syllabus
Suppl. 2: Signature Assignment
Suppl. 3: Itinerary
Suppl. 4: Student A Reflection Essay Sample
Suppl. 5: Student B Reflection Essay Sample

Author Biography

Matthew Beaky, PhD, is Professor of Physics at Juniata College, directing the Paul E. Hickes Observatory and Sparks Farm Robotic Observatory. He created the Secondary Emphasis in Astronomy and teaches courses including Observational Astronomy and Archaeoastronomy. He mentors student research on variable stars, eclipsing binaries, exoplanets, and asteroids, and is active in undergraduate research and international education. Dr. Beaky earned his PhD

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Amy Frazier-Yoder, PhD, is Professor of Spanish and Hispanic Cultures and Chair of the World Languages Department at Juniata College. Her teaching and scholarship examine gender fictions, self-conscious narratives, poetry and popular culture, and Latin American science fiction. She is the author of Creators and Created Beings in Twentieth-Century Latin American Fiction (2023). Committed to interdisciplinary and experiential learning, she co-creates study abroad programs in Latin America and community engagement programs such as the Graduation Forest.

Jamie Weaver, PhD, is Dean of International Education at Juniata College, where she leads the College's internationalization efforts with a dedicated team. She previously served as Director of Study Abroad at Juniata and as an Education Abroad Adviser at Penn State University. Dr. Weaver earned her PhD from Penn State University in 2020. Her research focuses on the employability of undergraduate study abroad students and the impact of global learning on career readiness and student success outcomes.