Summer Science Program
Open Call for New Curricula

Information for prospective curriculum authors
• Summer Science Program mission and goals
• Original project in Astrophysics
• Required criteria
• Recommended criteria
• Evaluation timeline and funding
• Q&A
What is SSP

- 39-day residential program
- Independent non-profit
- On college campuses
- For rising high school seniors
- Highly gifted in math & science
- Interested in a STEM career
- From around the world
- Selective - ~10% admission rate
- Non-credit, no tests, no grades
History

- Created in 1959 as a response to Sputnik
- Every summer since, students in the astrophysics program have observed an asteroid and calculated its orbit
  - Expansion into Biochemistry in 2014-2017
- Since 1999, an independent non-profit managed and largely funded by its own alumni
- Governed by a Board of Trustees elected by alumni and former faculty
- Officers are all volunteers
Mission and Goals

• Our students are at a key inflection point, just before applying to college
• Accelerate their intellectual and social development
• Focus and upgrade their aspirations for college and career
• A transformative, “educational experience of a lifetime”
Key Design Elements

• 12 teams of 3 students
• Each team completes a hands-on research experiment themselves, start to finish
• Real science, not a lab, not coursework
• Lectures and homework support the research
• Distinctive culture including many traditions and strong alumni involvement
Faculty

• **Two academic faculty** (college professors) deliver lectures and help manage the research teams

• **Site Director** handles administration, facilities, health, behavior

• **4 Teaching Assistants** combine academic and residential mentoring, live in dorm with students

• All 7 faculty **live on campus** for six weeks
Social Context

- Close-knit community of scholars
- Honor Code
- Collaboration, not competition
- Motivation is the joy of learning and discovering, not grades
- Simulate college (no curfew)
- Simulate scientific research by doing a prototypical research project
Weekly Schedule

- Lectures: 7-8 blocks of 3 hours each per week
- Field trips: 1 scientific, 1 recreational
- Guest Lectures: 1-2 per week
- Evenings for homework and lab work
- “Mandatory fun” such as movie nights
- Very little “free time” – for either students or faculty!
Example: The Astrophysics Curriculum

• Orbit Determination for near-earth asteroid
• Take several images of a near-earth asteroid over several weeks
• Submit the observations to the Minor Planet Center’s public database
• Write a Python program to fit an orbit to those observations and predict future positions
Lectures / Classroom

- Observational astronomy
- Vector calculus
- Classical mechanics (physics)
- Delivered at a college sophomore or junior level, but at a faster pace
- Homeworks to reinforce material and work toward the ultimate goal
Why another new Curriculum?

• Open more campuses to benefit more students
• Diversification into another field of science will reach different pools of applicants and faculty
Required Criteria of a New Curriculum
Common project

Each team of 3 (possibly 2 or 4) students will conduct the same or very similar research, but will generate their own original data. Each team could be responsible for generating one aspect of a larger project, such that data from all teams are needed for the final analysis. But all students apply broadly the same techniques and tools to different instances.
Scientifically relevant

The common project should not be a mere lab experiment, for which the “correct results” are already known and would not advance science whatsoever. Student results should be at least minimally novel and useful, and this should continue to hold true for at least the next five years, preferably longer.
Experimental concepts

Employs many of the key concepts of experimental science, such as experiment design, controls, data reduction, error analysis, calibration, signal-to-noise ratio, statistical analysis, etc. as applicable. Requires students to face experimental realities such as negative, ambiguous, poor quality, or unexpected results.
Duration

The experiment or measurements and analyses can be reliably **started and completed** in 32-35 calendar days, by each student team. Successful completion should not be guaranteed, but should be a reasonable expectation if prescribed procedures and techniques are followed.
Novel material

Most of the available ~120 hours of classroom time are needed to teach concepts not normally taught in high school, so that few, if any, students have already learned the specific academic material and experimental techniques that will be taught.
Challenging

The difficulty of the project and related academic material is at an undergraduate college (sophomore-junior) level. Highly gifted rising high school seniors will be challenged – possibly for the first time in their lives - to understand the material at the rapid pace it will be presented.
Accessible, transferable techniques and equipment

Uses equipment which is available at multiple college campuses. A project requiring custom, leading-edge, unproven, or particularly hazardous techniques or equipment would make it difficult to find faculty to teach the program and a campus to host it.
Recommended Criteria
Minimize “black boxes”

To the extent practicable, the curriculum should be taught from first principles, and avoid techniques or equipment that require the students to operate in the absence of meaningful understanding.
Interest level

Involves an area of science that has above-average appeal to students, because it is perceived to be particularly exciting and relevant.
Interdisciplinary

Ideally, the project draws from more than one STEM discipline. While the base discipline must be in an area of STEM, other non-STEM disciplines may be part of the interdisciplinary nature. For example, a project might include biology, epidemiology, socioeconomic factors, and statistics.
Computer Science

Computer programming techniques and skills are taught for data reduction and/or analysis.
Student Accountability

Allows each student to personally “own” a specific measurement or outcome.
Manageable costs

Does not require purchase of expensive equipment or a large budget for consumables or outside services.
Project Funding and Development
Selected proposal(s) will be provided with funding to cover the work and supplies needed to complete the curriculum development and testing.
Timeline

- Development (6 months)
- Testing (3-9 months)
- Pilot (summer, 6 weeks)
- Deployment (summer following pilot)
Visit www.summerscience.org to learn more

Questions? Email Chief Academic Officer Dr. Amy Barr Mlinar cao@ssp.org

Thank you for your time!