

Space Physics for Science Teachers Course Syllabus

Science Teacher Education Program (STEP)

Course Information:

Title: Space Physics for Science Teachers

Course Number: ED 595/GEOS 595

Credits: 3

Prerequisites: Participating educators must be from schools involved in the Science Teacher Education Program administered by the Geophysical Institute. Approved districts include: Alaska Gateway, Delta Greely, Fairbanks North Star Borough, Lower Kuskokwim, Northwest Arctic Borough, Tanana City, Yukon Flats, and Yukon-Koyukuk. Concurrent enrollment in STEP's Science Curriculum Development for Teachers is required.

Location: Session 1: IARC 401 OR Session 2: Irving 201

Dates: Monday-Friday, Session 1: July 24 – August 4 OR Session 2: July 31 – August 11

Meeting Time: 8 AM - Noon

Session 1 Instructor: Dirk Lummerzheim

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Office Hours: TBA

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Session 2 Instructor: Neal Brown

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Course materials/textbooks: TBD

Course Description:

Space Physics for Science Teachers is a special topics course designed to introduce K-12 science teachers to current studies in space physics through lecture, modeling exercises and tactile demonstrations at research facilities. Within the context of aurora, space physics, and upper atmospheric research, the course builds a foundation of understanding in topics such as the scientific processes, physics and chemistry of the upper atmosphere, atomic and molecular structure and reactions, electricity and magnetism, and dynamics and structure of the solar system, all of which are included in the Alaska Grade Level Expectations (GLEs) for Science. The GLEs identify concepts Alaska K-12 students should master by graduation. Course lectures and experiences are presented for a collegiate audience, with in-class discussions to help participants simplify concepts for K-12 students. Modeling exercises and experiments demonstrated by course instructor are designed for easy duplication in (or modification for) elementary and secondary classrooms. Instruction also includes training in technology used in modern

research, such as computer modeling and data interpretation with access to geophysical and space physics data from the Internet.

Course Goals and Student Learning Outcomes:

The goal of this course is to provide participants with an understanding of current space physics research and the scientific expertise needed to simplify this content knowledge for K-12 students. The instructor will model various space physics phenomena and concepts, demonstrate research methods and tools at research facilities and guide participants in writing simplified space physics activities for K-12 students, which address the Alaska Science GLEs.

Instructional Methods:

This course utilizes a variety of instructional methods including:

- Lecture-delivered by instructor and/or guest lecturers
- Large group discussion
- Scientific modeling demonstrations
- Instructor-led tactile demonstrations at research facilities

Tentative Course Calendar:

Week 1:

- Day 1: Introduction to Space Physics and applications in the K-12 classroom. Overview of current research activities, space weather and society, historical development of our current understanding.
- Day 2: Earth, and the Sun: atmosphere, magnetosphere, atmospheric chemistry, solar wind, and nuclear reaction as the energy source of the sun. Demonstration of electricity and magnetic field experiments.
- Day 3: Understanding the Aurora I: the processes within the aurora, particle collision, aurora colors, atoms and molecules, light emission, light spectrum. Demonstration of prism experiments. Assignment: Begin working on Space Physics Lesson Plans #1 and #2 (due Day 9).
- Day 4: Modern Aurora Research: Class held at Poker Flat Research Range (lecture at Science Observation Center, Lidar Observatory, launch pads, Payload Assembly facilities, Launch Operations Blockhouse). Demonstration of all-sky camera image collection and interpretation at the Science Observation Center.
- Day 5: Understanding the Aurora II: Solar wind interaction with magnetosphere, electrical energy of the aurora and its impact on the magnetic field, predicting the aurora. Demonstration of data interpretation for aurora prediction.

Week 2:

- Day 6: Simplifying aurora physics concepts for the K-12 classroom (discussion).
- Day 7: Solar system: Dynamics of Earth and the moon, modeling the motion of Earth and the moon, understanding the seasonal and day/night cycles, understanding tides.
- Day 8: The universe: structure: galaxies, black holes, stars, planets. Time: speed of light, Big Bang, and Hubble expansion.
- Day 9: Simplifying space physics concepts and modern research for the K-12 classroom (discussion). Due: Space Physics Lesson Plans #1 and #2. Begin

Participant Presentations: Participants present one of the Space Physics Lesson Plans they have written for K-12 classrooms during this course. Instructor ensures scientific integrity of Lesson Plans.

Day 10: Complete Participant Presentations: Participants present one of the Space Physics Lesson Plans they have written for K-12 classrooms during this course. Instructor ensures scientific integrity of Lesson Plans.

Assignments:

Each participant must complete two Space Physics Lesson Plans for K-12 students (assigned on Day 3 and due on Day 9). Lesson Plans should target a specific grade level or range. The instructor will evaluate each 3-5 page Lesson Plan for the following:

- Accuracy of space physics concepts presented
- Alignment of lesson content with appropriate Alaska Science GLEs
- Inclusion of hands-on, age-appropriate scientific models, experiments and/or demonstrations
- Understanding of the processes of science
- Clarity of writing
- Statement of goals, learning objectives, detailed procedure, and assessment plan

Each participant must present one of their Space Physics Lesson Plans to the instructor and peers on Day 9 or 10 (as assigned). Presentations will be evaluated for scientific integrity, clarity and applicability to the K-12 classroom.

Course Policies:

Attendance is essential due to the condensed nature of the course. Make up assignments may be arranged as necessary. Participation in class discussions is required. Transportation for class held at Poker Flat Research Range will be provided.

Evaluation:

Grades will be based on the following:

1. Class attendance: 10%
2. Participation in class discussions: 20%
3. Space Physics Lesson Plan #1: 30%
4. Space Physics Lesson Plan #2: 30%
5. Presentation of one Space Physics Lesson Plan: 10%

A grade of **A** will be given for an overall score of 90% or higher. A grade of **B** will be given for 80-89%, **C** for 60-79%, **D** for 40-59% and **F** for <40%.

Disabilities Services:

The Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials. We will work with the Office of Disability Services (203 WHIT, 474-7043) to provide reasonable accommodations to students with disabilities.