



Introducing Astronomy Education into High School Physics Curriculum Through the Use of the University of North Dakota Observatory

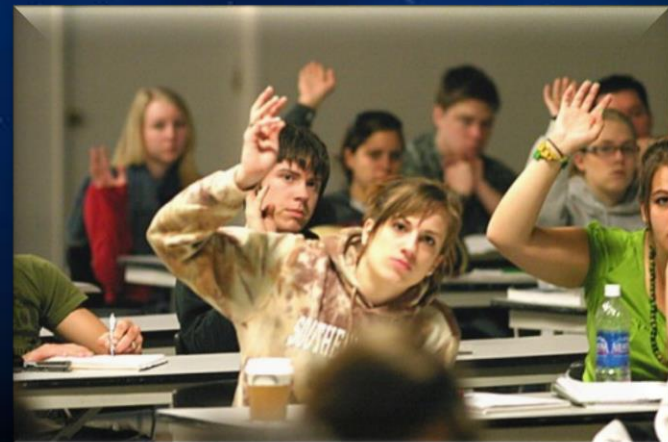
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May 7, 2012

Introduction

- Developed and taught a two week astronomy course to physics students at Grand Forks Central High School from April 16-27, 2012
- Along with in-class demonstrations, presentations, and activities, students were given the opportunity to visit the UND Observatory and the John D. Odegard School of Aerospace Sciences



Why do it?

- Programs like this do exist – just not in North Dakota
- UND Observatory = the only one in the state
 - Part of Mission of UND Observatory = Serving as educational resource
- Most science teachers have little to no training in astronomy (Beare et al., 2003)
- Astronomy is not a focus in local high school curriculum

First Week (April 16th – 20th)

- #1: Navigating the Night Sky
 - Celestial Coordinate Systems
 - Constellations
 - Seasons
- #2: Astronomical Distances
 - Solar System Distance Scale with the Sun as 7 cm diameter ball
 - Bill Nye the Science Guy video
 - Redshift and receding galaxies

Observational Astronomy
As Adapted for High School Advanced Physics

Lecture #1
Navigating the Night Sky

Hubble Space Telescope

Observational Astronomy
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Lecture #2
Astronomical Distances

Line of sight in January
Parallax
Line of sight in July
1 a.u.
Sun
Earth

Dr. Paul Hardersen, Cooperating Professor
Caitlin Nolley, Cooperating Student
University of North Dakota Space Studies Department

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Lecture #3
Our Moon and the Rules of the Solar System

Dr. Paul Hardersen, Cooperating Professor
Caitlin Nolley, Cooperating Student
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Lecture #4
Telescopes

UND Observatory

Observational Astronomy
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Lecture #5
Asteroids, Comets, and Their "Impacts"

Dr. Paul Hardersen, Cooperating Professor
Special thanks to Dr. Michael J. Gaffey
Caitlin Nolley, Cooperating Student
University of North Dakota Space Studies Department

UND Observatory

First Week (April 16th – 20th)

- #3: Our Moon and the Rules of the Solar System
 - Kepler's Laws
 - Lunar Phases demonstration
 - Eclipses
- #4: Telescopes
 - Different Types and characteristics
 - Overview of Observatory
 - Remote Observing

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Lecture #1
Navigating the Night Sky

Hubble Space Telescope

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First Week (April 16th – 20th)

- #5: Asteroids, Comets, and Their “Impacts”
 - Formation of Solar System
 - Craters and Energy
 - Activity with Chicxulub Crater and Size of Asteroid that caused the extinction of the dinosaurs

The collage consists of five overlapping lecture slides, each with a blue header and footer. The slides are:

- Lecture #1: Navigating the Night Sky** - Features an image of the Hubble Space Telescope. Header: "Observational Astronomy As Adapted for High School Advanced Physics". Footer: "Dr. Paul Hardersen, Cooperating Professor, Caitlin Nolley, Cooperating Student, University of North Dakota Space Studies Department".
- Lecture #2: Astronomical Distances** - Features a diagram of Earth's orbit around the Sun, showing the "Line of sight in January" and "Line of sight in July" to a star, with "Parallax" indicated. Header: "Observational Astronomy As Adapted for High School Advanced Physics". Footer: "UND Observatory" and "Dr. Paul Hardersen, Caitlin Nolley, University of North Dakota".
- Lecture #3: Our Moon and the Rules of the Solar System** - Features a diagram of the Moon's phases. Header: "Observational Astronomy As Adapted for High School Advanced Physics". Footer: "Dr. Paul Hardersen, Cooperating Professor, Caitlin Nolley, Cooperating Student, University of North Dakota Space Studies Department".
- Lecture #4: Telescopes** - Features an image of a spiral galaxy. Header: "Observational Astronomy As Adapted for High School Advanced Physics". Footer: "UND Observatory" and "Dr. Paul Hardersen, Caitlin Nolley, University of North Dakota".
- Lecture #5: Asteroids, Comets, and Their “Impacts”** - Features an image of a comet. Header: "Observational Astronomy As Adapted for High School Advanced Physics". Footer: "UND Observatory" and "Dr. Paul Hardersen, Cooperating Professor, Special thanks to Dr. Michael J. Caffey, Caitlin Nolley, Cooperating Student, University of North Dakota Space Studies Department".

April 20th – Visit to UND Observatory



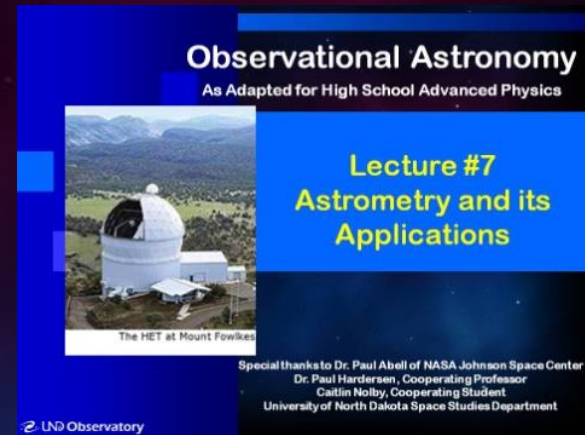
Second Week (April 23rd – 27th)

- #6: Computer Lab Day
 - Wrote “scripts” for remote observing of an asteroid
 - Explored Simulated ACP Observatory Control Software
 - Learned how to search for Information about solar system objects using databases



Second Week (April 23rd – 27th)

- #7: Astrometry and Its Applications
 - Impacts in Modern Society
 - Understanding CCDs (Cameras) and Images
 - Activity with images of asteroids and mission to an asteroid

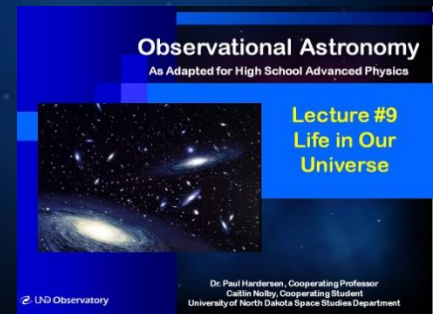
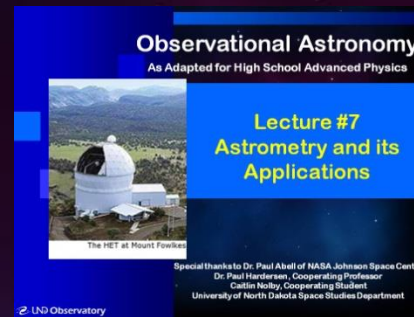


April 25th: Visit to UND Aerospace



Second Week (April 23rd – 27th)

- #9: Stars
 - Stellar Formation
 - Classification
 - Star Life Cycle
- #10: Life in Our Universe
 - Big Bang
 - Life on Earth
 - NASA Missions out of our solar system
 - Kepler Search for Exoplanets



Goals

- Better prepare students for college astronomy courses
- Make UND Observatory more visible
- Evaluate student enjoyment, progress, and overall perception of the course for future improvements
- Make astronomy education an option for high school students throughout North Dakota

