Preface:
Kopernik Observatory and Science Center
698 Underwood Road, Vestal, NY 13850
607-748-3685
info@kopernik.org

ABOUT:
The Kopernik Observatory & Science Center, perched atop a 1750 foot hill in Vestal, 13 miles Southwest of Binghamton, NY, has been the best-sited and best equipped public observatory in the Northeast United States for over 40 years. It offers a wide range of programs, both on-site and in-school programs that provide hands-on, interactive activities designed to enhance the science and engineering curriculum being taught in school.

NGSS – Next Generation Science Standard
As implementation of the Next Generation Science Standards (NGSS) is about to be rolled out, educators at Kopernik have reviewed and revised the course offerings to better align them to the new standards. To that end, Kopernik has added some new courses and have updated others. The Learning Standards for Science have been re-stated and are now listed by the NGSS Grade Level Performance Expectations in the Disciplinary Core Domains. PS stands for the Physical Sciences. LS stands for the Life Sciences. ESS stands for the Earth and Space Sciences. ETS stands for the Engineering, Technology and Application of Science.

LINKS:
Website: www.kopernik.org
Facebook KOPERNIK Observatory & Science Center
Twitter: @KopernikObserv
Instagram: kopernikobservatory
Program Offerings:

Programs Held at Kopernik

The Order of the Universe
(Grades 1-2) (Grades 3-5) (Grades 6-8)

Students explore the relationship of how astronomers almost exclusively use the electromagnetic spectrum to learn about a variety of celestial objects. They will experience through hands-on modeling the scale of the solar system and beyond. Use of a planetarium simulator will demonstrate astronomical cyclical patterns to students. Students will predict the interactions of a laser beam passing through different materials and will observe that different gases when ionized release unique spectra. If clear, students will safely observe the sun and daytime planets such as Venus with Kopernik’s telescopes. On cloudy days, telescope tour will have students learning about the different types of telescopes that astronomers use.

Learning Standards for Science (grades 1-2)

1-ESS1-1 Use observations of the sun, moon, and stars to describe patterns that can be predicted.
1-PS4-2 Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.
1-PS4-3 Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.

Learning Standards for Science (grades 3-5)

5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.
MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

Learning Standards for Science (grades 6-8)

MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Learning Standards for Common Core English Language Arts:

• Asking and Answering Questions
• Communicating Information and Ideas

Common Core Learning Standards: English Language Arts:

• Presentation of knowledge and ideas
• Vocabulary acquisition and use

Venue: Kopernik Observatory

Venue Cost: $12.00 per student Chaperones are complimentary

District Cost: Venue Cost + BOCES 18% fee

Class Limit: Minimum class size = 16 students

Length of Program: 2 hours
Earth Systems: Rocks, Volcanoes and Earthquakes
Grades 3-5
Students classify rocks, identify minerals, and explore plate tectonics through the study of earthquakes and volcanoes. Students work in small teams to make a “smoking” volcano erupt and use mapping skills to explore volcano and earthquake activity on an interactive world map.

Learning Standards for Science:
4-ESS2-2: Analyze and interpret data from maps to describe patterns of Earth’s features.
ESS2.B: Plate Tectonics and Large-Scale System Interactions

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Class Limit: Minimum class size = 16 students
Length of Program: 2 hours

Earth Systems: Rocks, Volcanoes and Earthquakes
Grades 6-8
Students classify rocks, identify minerals, and relate to their origin within the rock cycle. They explore plate tectonics through the study of earthquakes and volcanoes. Students work in small teams to make a “smoking” volcano erupt and use mapping skills to explore volcano and earthquake activity on an interactive world map.

Learning Standards for Science:
MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Disciplinary Core Ideas:
ESS2.B: Plate Tectonics and Large-Scale System Interactions
ESS1.C: The History of Planet Earth
ESS2.A: Earth’s Materials and Systems
ESS2.B: Plate Tectonics and Large-Scale System Interactions

Common Core Learning Standards:
English Language Arts:
- Presentation of Knowledge and Ideas
- Vocabulary Acquisition and Use

Learning Standards for Science:
- Use Scientific Inquiry to Pose Questions, Seek Answers, Develop Solutions

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District Cost: Venue Cost + BOCES 18% fee
Class Limit: Minimum class size = 16 students
Length of Program: 2 hours

Programmable Robotics using LEGO “WeDo” (Grades 2-5)
Kopernik educators utilize LEGOs to introduce the technology of gears and motors in an engaging project called “Dancing Birds”. Classes of up to 24 students will work in pairs using WeDo mini-kits to follow directions and construct their models. Students will also learn introductory coding to program their birds to move. Lego WeDo software download is necessary to “plug-in” computers.

Learning Standards for Science: PS2 Motion and Stability: Forces and Interactions:
3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object
3-PS2-2. Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.

Learning Standards for Engineering:
K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Learning Standards for Common Core English Language Arts:
- Asking and Answering Questions
- Communicating Information and Ideas
- Engaging in Argument from Evidence
- Vocabulary Acquisition and Use

Venue: Kopernik Observatory
Venue Cost: $12.00 per student Chaperones are complimentary
District Cost: Venue Cost + BOCES 18% fee
Class Limit: Minimum class size = 16 students
Length of Program: 2 hours
Elementary Astronomy: Earth’s Place in the Universe

(Grades 1-2)(Grade 5)

Students will model the movement of the Sun, Earth and the Moon to observe and analyze patterns in their positions at different times (ex: Summer and Winter Seasons). Students will act out and observe changes in shadows to predict the position of the Sun in the sky (ex: sunrise, sunset). Students will test and analyze rocks from Earth and from Space (meteorites) to look for patterns that can help group rocks together. All students will be given an opportunity to observe the Sun live through Kopernik’s Solar Telescopes, thus providing evidence of natural phenomena.

Learning Standards for Science:

1-ESS1-1 Use observations of the sun, moon, and stars to describe patterns that can be predicted.

1-ESS1-2 Make observations at different times of year to relate the amount of daylight to the time of year.

2-ESS1-1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

5-ESS1-1. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.

5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Learning Standards for Common Core English Language Arts:

• Participate in shared research
• Recall and gather information
• Reason abstractly and quantitatively
• Use tools appropriately
• Model with mathematics

Venue: Kopernik Observatory

Venue Cost: $12.00 per student       Chaperones are complimentary

District Cost: Venue Cost + BOCES 18% fee

Class Limit: Minimum class size = 16 students

Length of Program: 2 hours
Middle School Astronomy: Earth’s Place in the Universe

(Grades 6-8) Course description:

A. Students will create & act out several models of the Solar System kinesthetically, describing patterns in Lunar, Earth and Solar movement, while supporting the argument that objects like the Sun appears brighter when closer to us.

B. Students will observe stars and planets through Earth- based (Kopernik Observatory) and space- based (SOHO and Hubble) telescopes, then describe and interpret the data.

C. Students will test, analyze rocks from both Earth and Space (meteorites, lunar sample) to determine properties of objects in our Solar System. Students will examine and analyze fossil samples and rock layering models to construct an evidence- based explanation of (their portion of) the geologic time scale and its logical use in explaining the Earth’s 4.6 billion- year- old history.

Learning Standards for Science:

MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.

MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

Learning Standards for Common Core English Language Arts/ Mathematics:

- Reason abstractly and quantitatively
- Model with mathematics
- Cite textual evidence to support your analysis
- Understand the concept of ratio

Venue: Kopernik Observatory

Venue Cost: $12.00 per student Chaperones are complimentary

District Cost: Venue Cost + BOCES 18% fee

Class Limit: Minimum class size = 16 students

Length of Program: 2 hours
Ecosystems (Grades 2-5)
Students will participate in “hands-on” investigations to discover how plants and animals grow, reproduce, and survive within an ecosystem. They will learn how organisms perform different functions within a group, adapt to changing environments, and how energy transfers through food webs. Students in grades 3-5 will also be challenged to solve an environmental based problem.

Learning Standards for Science: LS2 – Ecosystems: Interactions, Energy and Dynamics:
(Grade 2)
2-LS2-1 Plan and conduct an investigation to determine if plants need sunlight and water to grow.
2-LS2-2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Learning Standards for Science (Grades 3-5):
3-LS2-1 Construct an argument that some animals form groups that help members survive.
3-LS4-2 Use evidence (e.g., observations, patterns) to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
5-PS3-1 Use models to describe that energy in animals’ food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

Learning Standards for Common Core English Language Arts:
• Asking and Answering Questions
• Communicating Information and Ideas
• Engaging in Argument from Evidence
• Vocabulary Acquisition and Use

Learning Standards for Engineering/Technology Education:
• K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
• 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Venue: Kopernik Observatory
Venue Cost: $12.00 per student Chaperones are complimentary
District Cost: Venue Cost + BOCES 18% fee
Class Limit: Minimum class size = 16 students
Length of Program: 2 hours
Electricity and Magnetism
Grades 3 – 8

Grade 3-8: Students experiment with hands-on experiments showing how magnets interact with each other, and how they interact with non-magnetized materials (ferrous and non-ferrous). Using electromagnets, they will show how electricity produces magnetism. Students will experiment with simple circuits involving lights and motors. They will distinguish between static and flowing electricity. The scientific method will be emphasized in all activities.

Grades 6-8: Students will discover that not only will electricity produce magnetism, but conversely, magnetism can also produce electricity.

Learning Standards for Science:
3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact

Learning Standards for Technology Education:
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions

Learning Standards for Common Core English Language Arts:
• Asking and Answering Questions
• Communicating Information and Ideas
• Engaging in Argument from Evidence
• Vocabulary Acquisition and Use

Venue: Kopernik Observatory

Venue Cost: $12.00 per student Chaperones are complimentary

District Cost: Venue Cost + BOCES 18% fee

Class Limit: Minimum class size = 16 students

Length of Program: 2 hours
Waves: Sound and Light  
(Grades 3-8)

Students will explore wave motion and how it is used to understand sound and light. With sound, they will investigate the concept of frequency and amplitude and how these affect pitch and loudness. By experimenting they will learn how waves travel. Students will investigate how waves can be used to transmit information. They will distinguish between a “pure tone” (example a tuning fork) and composite tones (example the human voice). Students will “view” sound waves with an oscilloscope. Wave concepts learned in the study of sound will be extended to light. Students will explore the spectrum of light investigating both visible and invisible wavelengths (infra-red and UV). Concepts of the light spectrum will be used to understand how scientists can determine the composition and age of the sun or a star. Students will finally observe the properties of LASER light.

Learning Standards for Science:
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.
MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

Learning Standards for Engineering:
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Common Core Learning Standards: English Language Arts:
- Presentation of knowledge and ideas
- Vocabulary acquisition and use

Venue:       Kopernik Observatory

Venue Cost: $12.00 per student           Chaperones are complimentary

District Cost: Venue Cost + BOCES 18% fee

Class Limit: Minimum class size = 16 students

Length of Program: 2 hours
Build Your Own Science, Technology, Engineering and Math Program
(Grades K-12)

Call us to design a fun day that will reinforce your curriculum with hands-on learning for every child. Kopernik has the equipment, trained teachers and labs ready for you. Example: Kopernik’s “Stories in the Stars” is a big success with K-5. Students read stories in ELA, they come to Kopernik to discover the stars, constellations, planets, & moons.

We can draw from the various other programs offered at Kopernik to fit your curriculum.

Venue Cost: $12.00 per student  
Chaperones are complimentary

District Cost: Venue Cost + BOCES 18% fee

Class Limit: Minimum class size = 16 students

Length of Program: 2 hours
Programs Held in Your School

Programmable Robotics using LEGO “WeDo”  
(Grades 2-5)  
Kopernik educators utilize LEGOs to introduce the technology of gears and motors in an engaging project called “Dancing Birds”. Classes of up to 24 students will work in pairs using WeDo mini-kits to follow directions and construct their models. Students will also learn introductory coding to program their birds to move. Lego WeDo software download is necessary to “plug-in” computers. Kopernik will work with the School IT department on the software installation.

Learning Standards for Science: PS2 Motion and Stability: Forces and Interactions  
3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object  
3-PS2-2. Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.

Learning Standards for Engineering:  
K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.  
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.  
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.  
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Learning Standards for Common Core English Language Arts:  
- Asking and Answering Questions  
- Communicating Information and Ideas  
- Engaging in Argument from Evidence  
- Vocabulary Acquisition and Use

Venue: In-school computer lab  
Venue Cost: $9.00 per student  
Chaperones are complimentary  

In-school programs outside Broome County are subject to a round trip mileage/travel time fee of $1.20/mile distance from Kopernik to the school.  

District Cost: Venue Cost + BOCES 18% fee  

Class Limit: Minimum class size = 16 students  

Length of Program: 1 hour
Electricity and Magnetism
Grades 3 – 8

Grade 3-8: Students experiment with hands-on activities showing how magnets interact with each other, and how they interact with non-magnetized materials (ferrous and non-ferrous). Using electromagnets, they will show how electricity produces magnetism. Students will experiment with simple circuits involving lights and motors. They will distinguish between static and flowing electricity. The scientific method will be emphasized in all activities.

Grades 6-8: Students will discover that not only will electricity produce magnetism, but conversely, magnetism can also produce electricity.

Learning Standards for Science:
3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact

Learning Standards for Technology Education:
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions

Learning Standards for Common Core English Language Arts:
- Asking and Answering Questions
- Communicating Information and Ideas
- Engaging in Argument from Evidence
- Vocabulary Acquisition and Use

Venue: Kopernik Observatory
Venue Cost: $9 per student Chaperones are complimentary

In-school programs outside Broome County are subject to a round trip mileage/travel time fee of $1.20/mile distance from Kopernik to the school.

District Cost: Venue Cost + BOCES 18% fee

Class Limit: Minimum class size = 16 students

Length of Program: 1 hour
KOPERNIK IN-SCHOOL PROGRAM FOR LARGE GROUPS
(Grades PreK -12)

Kopernik understands your concern about travel costs, and offers your students an interactive Space Science presentation at your school. Narrated by our knowledgeable staff, we challenge your students to set high goals and instill in them a desire to study Math & Science and be part of future Space Science Technology.

Common Core Learning Standards: English Language Arts:
• Presentation of Knowledge and Ideas
• Vocabulary Acquisition and Use

Common Core Learning Standards: Mathematical Practices:
• Reasoning Abstractly and Quantitatively
• Modeling with Mathematics
• Measurements and Data

Learning Standards for Science:
• Use Scientific Inquiry to Pose Questions, Seek Answers, Develop Solutions
• Apply Scientific Concepts, Principles, and Theories Pertaining to Physical Setting and Living Environment

Venue Cost: $9.00 per student  Chaperones are complimentary

District Cost: Venue Cost + BOCES 18% fee

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