EXPLORING
the EARTH in MOTION Grades 3-6

Key idea:

Outdoor shadow patterns, day and night, and the apparent motion of the Sun and its changing path in the sky can be described in terms of the Earth's changing orientation to the Sun.

Specific Learning Objectives

Unit 1: Investigating Shadows

Exploration 1: Shadows on a Flat Surface

- The length and direction of a shadow depend upon the relative positions of the light source, the object blocking the light, and the surface on which the shadow is cast.
- The greater the angular height of a light source relative to a flat surface, the shorter the shadow cast by an object on that surface.

Exploration 2: Shadows on a Spherical Surface

- The length and direction of a shadow on a spherical surface depend on the relative position of the light source and the object casting the shadow, as well as on the orientation of the object.

Exploration 3: Tracking Outdoor Shadows

- The length and direction of an outdoor shadow of a fixed object change over time each day in regular and predictable ways.
- Shadows of a fixed object cast in sunlight move with a regular clockwise pattern in the northern hemisphere.
- The shortest outdoor shadow of an object occurs at local noon.
- Shadows of a fixed object at any one particular time of day change in a predictable way over the course of a year as a result of changes in the angular height of the Sun above the horizon.

Unit 2: The ARIES Astronomy Lab

Exploration 4: The ARIES Shadow Theater

- The shape, length, and direction of a shadow depend upon the shape and orientation of the object and the relative position of the light source, object, and surface on which the shadow is cast.

Exploration 5: Building the ARIES Astronomy Lab

- Modeling is the way scientists understand nature.
- Models are used to predict how nature behaves under different conditions.

Exploration 6: Using the Lab to Model Night and Day

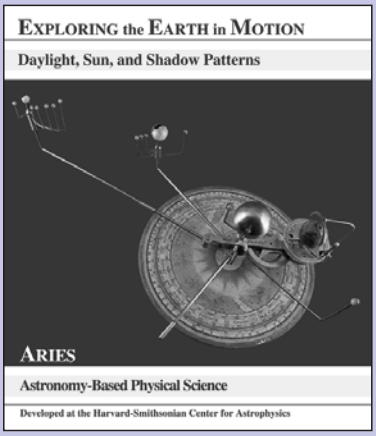
- Day and night occur as different portions of the surface of the turning Earth move into or out of sunlight.

Exploration 7: Measuring Hours of Daylight and Darkness

- At any given moment, about half of the Earth's surface area is illuminated by sunlight, but the location of that half changes daily and throughout the year.

Important content:

- Patterns of outdoor shadows during the course of the day
- Changing patterns in hours of daylight
- Using a magnet to find direction
- Measuring the angular height of the Sun
- Patterns of the Sun's apparent motion in the sky at different times of the year
- Nature of lenses
- Building and using a refracting telescope



Exploration 8: Daylight Hours at Different Locations on the Same Day

- At the summer solstice for the northern hemisphere, the number of daylight hours increases the farther north you are from the Tropics. North of the Arctic Circle, the region remains illuminated during one complete turn of the Earth. At the same time, the entire region of the Earth south of the Antarctic Circle remains in darkness.
- At the winter solstice for the northern hemisphere, the number of daylight hours decreases the farther north you are from the Tropics. North of the Arctic Circle, the region remains in darkness during one complete turn of the Earth. The entire region south of the Antarctic Circle remains illuminated for the same time.

Unit 3: Tracking the Sun in the Sky

Exploration 9: Locating Landmarks with a Map

- A map is used to represent locations on the Earth's surface.

Exploration 10: Using a Magnet to Find Directions

- One end of a suspended magnet will orient itself to point toward a location on Earth called magnetic north.

Exploration 11: The ARIES Suntracker

- The daily path of the Sun and its maximum angular height above the horizon change throughout the course of a year.

Unit 4: The ARIES Refracting Telescope

Exploration 12: Assembling the ARIES Refracting Telescope

- A refracting telescope contains a series of lenses through which objects are directly viewed.
- An image produced in a simple refracting telescope is both inverted and reversed. That is, the object appears upside down, and the left side of the object is on the right (and vice versa).

Exploration 13: Using the ARIES Refracting Telescope

- A telescope allows us to see objects or features on objects too small or too faint to be distinguished or seen with the unaided eye.