

# Introduction

This magnetism teacher’s guide is one of four activity guides—plus a background guide for teachers—that provide students with the opportunity to build on science concepts related to Earth’s magnetism and its changes, as detected by THEMIS magnetometers located in schools across the U.S. The four activity guides have been used in different types of classes, from physical science and physics classes, to geology classes and astronomy classes. The excitement of actually participating in the THEMIS project helps motivate the students to learn challenging physical science concepts.

The background guide for teachers, the **THEMIS GEONS Users Guide** describes the important role that terrestrial magnetism plays in shaping a number of important Earth systems. It also explains the basic operating principles behind magnetometers—particularly the system you are now in the process of using to investigate magnetic storms at your school.

**Magnetism and Electromagnetism** is the first of the four activity guides. It contains a review of basic magnetism similar to what is encountered in most grade-level physical science texts. Students are introduced to magnets, the concepts of polarity and magnetic lines of force, and electromagnetism (generators and Lenz’s law). These materials are generally used by teachers presenting Earth and Physical Science courses in grades 6-9, and occasionally presented as a lab at the end of high school physics classes. These activities, while not directly tied in to NASA space science, are a prerequisite to understanding magnetism on Earth and in space.

**Exploring Magnetism on Earth** is the second activity guide. It is intended to help students explore Earth’s magnetic field through a variety of hands-on activities. This guide contains problems focusing on Earth’s changing magnetic field in time and space, and how these changes can impact navigation on Earth’s surface. Students use basic math skills to interpret graphical information showing polar wander and magnetic changes, and answer questions about quantitative aspects of these changes. These activities have been classroom-tested with students of many different levels of proficiency in math and science. The lessons have been used in geology and astronomy classes.

**Space Weather** is the third guide in this sequence. It introduces students to Earth’s magnetic field and aurora within the context of the Sun and space weather. The guide covers the Earth’s magnetosphere, time zones and Universal Time, the evolution of auroras, and space weather forecasting using geomagnetic indices. These activities have also been classroom-tested in classrooms with students of many different levels of proficiency in math and science. The lessons have been used in physics and astronomy classes as well.

**Earth’s Magnetic Personality** is the fourth and final guide, which was developed with the goal that students can work directly with the THEMIS magnetometer data. The guide covers vectors, the x-y-z magnetometer plots, creating a prediction for aurora using the magnetometer data, calculating the total magnetic field strength and observing it over months, and the waves in Earth’s magnetic field excited by large magnetic storms.