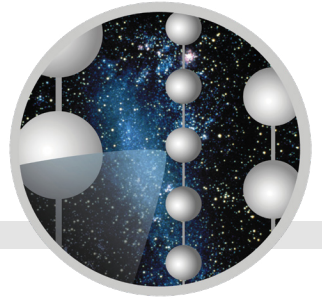


# Resources for STEM Educators

## ICECUBE IN THE CLASSROOM



[go.wisc.edu/a3qi7z](http://go.wisc.edu/a3qi7z)

### LEARN ABOUT ICECUBE

#### Introduction to IceCube Presentation

An introductory presentation about the IceCube detector and science is available in two formats. A live presentation via Skype by IceCube researchers can be requested for students of all ages. We also can provide a [guided PowerPoint](#) presentation, which includes notes for teachers and is suitable for 5th grade and above.

For more information, contact [learn@icecube.wisc.edu](mailto:learn@icecube.wisc.edu).

#### Polar Webcasts

The Wisconsin IceCube Particle Astrophysics Center (WIPAC) offers your K-12 classroom connections with scientists, technicians, graduate students, and support personnel at the National Science Foundation-run South Pole station. IceCube's South Pole team talks with students via Skype about working in one of the most extreme environments on Earth, as well as other topics focusing on IceCube science and technology.

Sign-up and more information online: [icecube.wisc.edu/outreach/webcasts](http://icecube.wisc.edu/outreach/webcasts)

#### Chasing the Ghost Particle

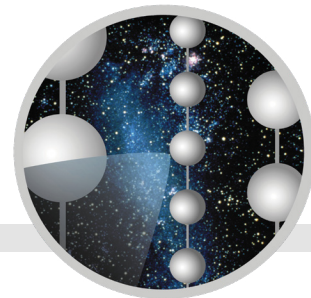
In this 30-minute show, stunning simulations of the most energetic places in our universe, and the galaxies around us, are the prelude to a thrilling journey inside IceCube. From one of the most remote locations on Earth to the unexplored regions of the cosmos, *Chasing the Ghost Particle: From the South Pole to the Edge of the Universe* will take you on a journey you won't forget.

More information as well as a flat screen download of the film is available online: [wipac.wisc.edu/ghostparticle](http://wipac.wisc.edu/ghostparticle)



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## RESEARCH-BASED ACTIVITIES

### Search for Neutrino Sources with IceCube

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Students reproduce a search for astrophysical sources of high-energy neutrinos using IceCube data. Resources for teachers includes a general description, an example of a talk to guide the analysis, and randomized sky maps of the very high energy events detected in IceCube.

Activity resources and related lesson plan online: [go.wisc.edu/7skjek](http://go.wisc.edu/7skjek)

### In-Class Discussion and Particle Quizzes

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This collection of online activities allows students to learn about IceCube using real scientific data and tools.

**Particle Identification Quiz:** Students will learn how to identify the different type of particles that IceCube detects. This activity is suitable for students of all ages.

**Neutrinos from outer space, or just atmospheric neutrinos:** Two sets of IceCube events are shown. Students have to look at their properties and guess which are neutrinos produced in the far and extreme universe and which are just muons produced by the interactions of cosmic rays with the Earth's atmosphere. This activity is suitable for 7th grade and above.

**The highest energy neutrinos:** IceCube has detected the highest energy neutrinos ever, with energies a thousand times higher than those achieved by the most powerful accelerators on Earth. A display shows a set of the highest energy neutrinos detected by IceCube. Using the displays, students try to determine which five have the highest energy. This activity is suitable for 7th grade and above.

Related lesson plan, High-Energy Neutrinos From the Cosmos: [go.wisc.edu/a3qi7z](http://go.wisc.edu/a3qi7z)

## HANDS-ON ACTIVITIES

### Neutrinos as Pieces of the Standard Model of Particle Physics

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This hands-on activity promotes connections between what students already know about particles, matter and the universe and the so-called ghost particles. Each student receives a particle identity card and teachers guide students through the standard model of particle physics with a special focus on the neutrino.

A detailed description of the activity can be found online: [go.wisc.edu/dmodd4](http://go.wisc.edu/dmodd4)

### Other Resources and Activities

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Researchers and teachers at IceCube have developed classroom-friendly activities that engage students in learning about:

- IceCube's construction by replicating the drilling process,
- particle detection by building cloud chambers, and
- the energy loss in a beta decay with "popcorn neutrinos."

Find these activities and their instructions online: [icecube.wisc.edu/outreach/activities](http://icecube.wisc.edu/outreach/activities)

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