World-Wide Science: Teaching and Learning Online

Svetlana Barkanova
Professor, Physics, School of Science and the Environment
World Wide Web was invented at CERN, home to the Large Hadron Collider, in 1989.

What are the main goals of the LHC?

The Standard Model of particle physics – a theory developed in the early 1970s that describes the fundamental particles and their interactions – has precisely predicted a wide variety of phenomena and so far successfully explained almost all experimental results in particle physics. But the Standard Model is incomplete. It leaves many questions open, which the LHC will help to answer.

- **What is the origin of mass?** The Standard Model does not explain the origins of mass, nor why some particles are very heavy while others have no mass at all. However, theorists Robert Brout, François Englert and Peter Higgs made a proposal that was to solve this problem. The Brout-Englert-Higgs mechanism gives a mass to particles when they interact with an invisible field, now called the “Higgs field”, which pervades the universe. Particles that interact intensely with the Higgs field are heavy, while those that have feeble interactions are light. In the late 1980s, physicists started the search for the Higgs boson, the particle associated with the Higgs field. In July 2012, CERN announced the discovery of the Higgs boson, which confirmed the Brout-Englert-Higgs mechanism. However, finding it is not the end of the story, and researchers have to study the Higgs boson in detail to measure its properties and pin down its rarer decays.

- **Will we discover evidence for supersymmetry?** The Standard Model does not offer a unified description of all the fundamental forces, as it remains difficult to construct a theory of gravity similar to those for the other forces. Supersymmetry – a theory that hypothesises the existence of more massive partners of the standard particles we know – could facilitate the unification of fundamental forces.

- **What are dark matter and dark energy?** The matter we know and that makes up all stars and galaxies only accounts for 4% of the content of the universe. The search is then still open for particles or phenomena responsible for dark matter (23%) and dark energy (73%).
“Community Profile”, Canadian Subatomic Physics Long Range Plan 2017-2021
In the Fall 2020, Grenfell Physics courses will be offered either remotely or fully online:

<table>
<thead>
<tr>
<th>Course</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 2056</td>
<td>Remotely</td>
<td>General Physics VI: Modern Physics is special relativity, quanta of light, atomic structure and spectral lines, quantum structure of atoms and molecules, nuclei and elementary particles.</td>
</tr>
<tr>
<td>PHYS 2150</td>
<td>Fully Online</td>
<td>The Foundation of Astronomy represents a general introduction to astronomy. The course emphasizes the scientific method, basic physics, night sky and objects in our solar system. Topics include space science, telescopes, spectroscopy, atomic structure, the formation and evolution of planetary systems, and the detection and properties of exoplanets.</td>
</tr>
</tbody>
</table>
Module 1: The Sun

- Overview
- Web Page

Topic 1: Physical Properties of the Sun
- Web Page

Topic 2: The Solar Interior
- Web Page

Topic 3: The Solar

ENGAGE!
Locate each of the following regions on the Solar Structure images above:
- Photosphere
- Chromosphere
- Transition zone
- Corona
- Convection zone
- Radiation zone
- Core

Photosphere
Spring Equinox: The Sun rises due east today, but will rise slightly north of due east tomorrow.

Summer Solstice: The noontime Sun reaches its highest point of the year and it is the longest day (most daylight) of the year.

Fall Equinox: The Sun has declination 0 degree today, but will have a negative declination tomorrow.

Winter Solstice: The Sun crosses the meridian 23.5 degrees lower in altitude than the celestial equator. Sunset occurs at its farthest point south of due west for the year. The noontime Sun casts the longest shadows.
Come and explore the Universe with us!

We have streams in subatomic physics and astrophysics, small classes taught by leading world experts, and research opportunities for students at all levels. Online and remote course delivery.

The Power of Physics

A Physics Masters Degree Opens Doors to Different Career Paths

Employment Sector of Physics Master's Degrees

- 45% Engineering
- 14% Physics or Astronomy
- 10% Other Science, Tech, Math
- 7% Non-STEM
- 24% Computer & IT

Learn more: go.aps.org/deeperInSight

In US, www.aps.org/careers