Unit B: Energy Flow in Technological Systems (Physics)
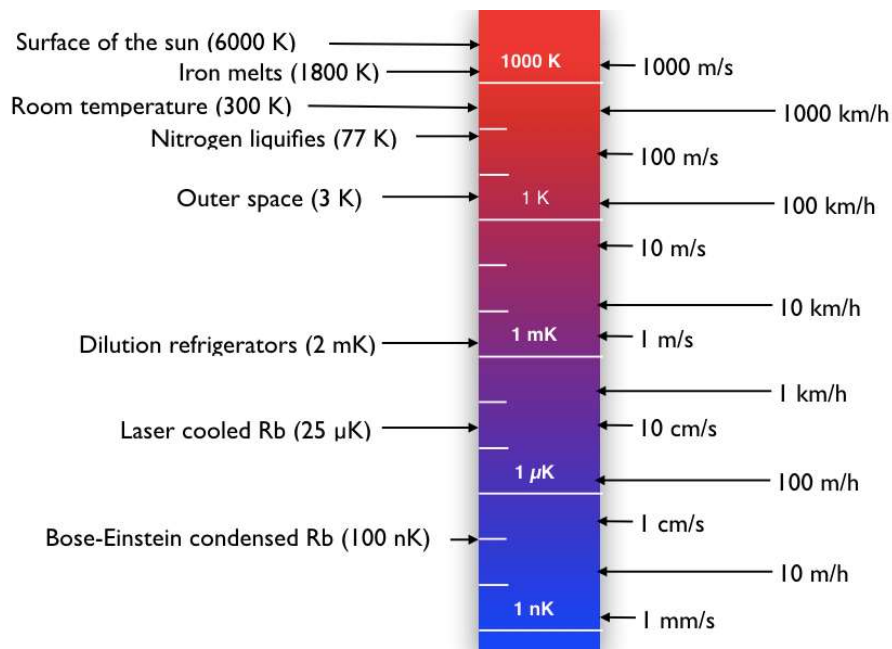
What is physics?

Physics is the science that deals with matter, energy, how systems change through space and time, and the fundamental nature of the universe
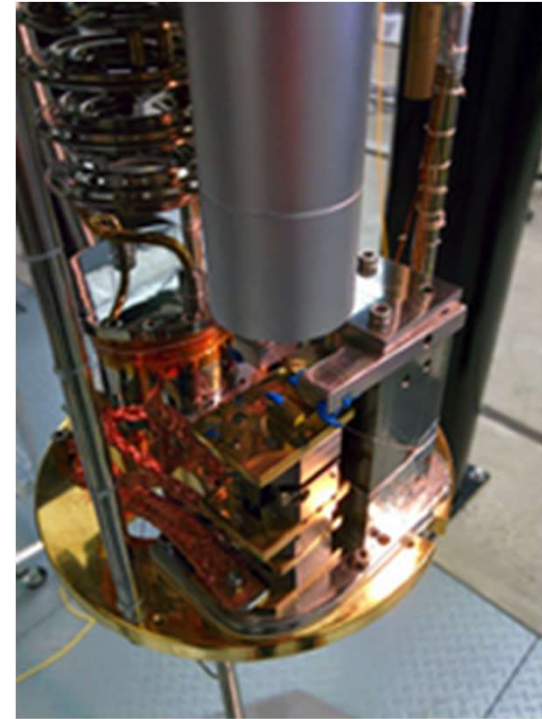
Physics can be done theoretically with mathematical analysis,or experimentally by collecting measurements.

Here in Alberta, we have a very strong, active physics community
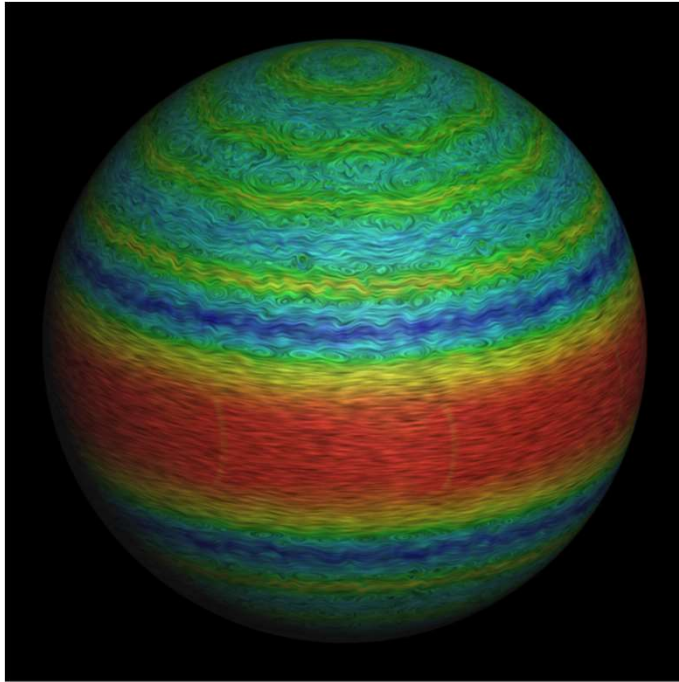
Physics Research in Alberta

The Ultracold Lab at the U of A (led by Dr. Lindsay LeBlanc) uses lasers to cool Rubidium to just above absolute zero, where atoms become unrecognizable

The Davis Lab at the U of A (Dr. John Davis) researches the supercooling of Helium 3 to create nanomachines, and quantum computers

Physics Research in Alberta

Dr. Moritz Heimpel at the U of A studies the magnetic fields of Jupiter, and its effects on the weather patterns and storms on the planet, as well as mantle and core convection of the Earth creating its magnetic field

Dr. Roger Moore and Dr. James Pinfold worked at the Large Hadron Collider, and helped discover the Higgs Boson Particle, the thing that lets us measure mass

Physics Research in Alberta

Atoms 4.9%

Dark Matter 26.8%

Dark Energy 68.3%

TODAY
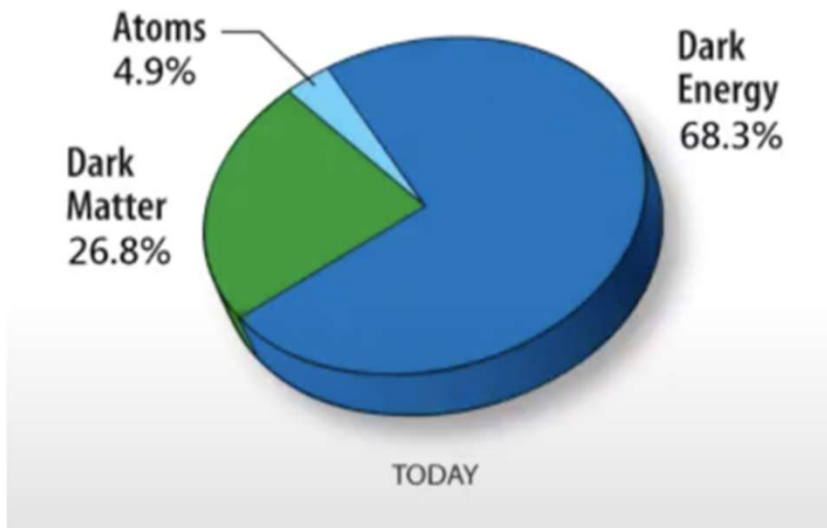
Dr. Nassim Bozorgnia researches dark matter and dark energy. Her work focuses on how we detect dark matter and its effects on the universe.
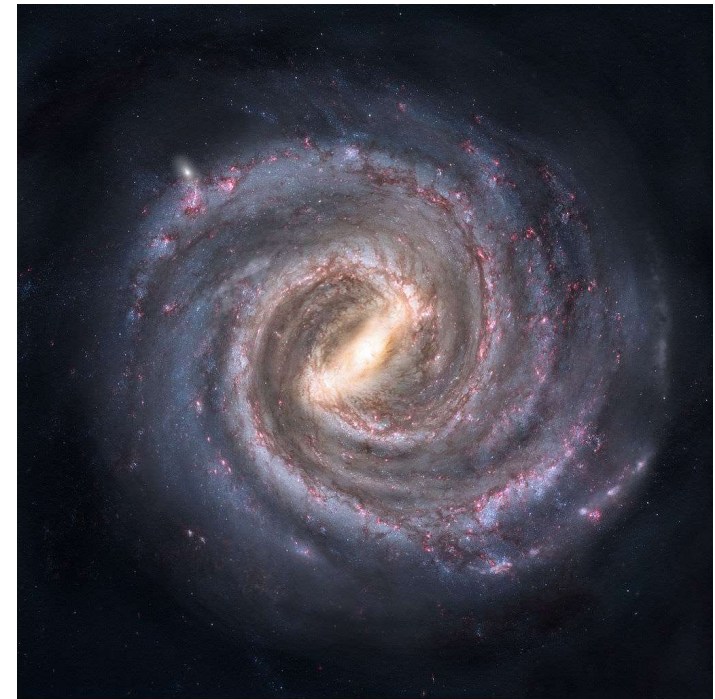
Dr. Sharon Morsink studies black holes and neutron stars, the densest objects in the universe. The gravity from black holes keeps galaxies together.

Math Skills

Math is a tool we'll use a lot in physics, but physics is not math!

We'll use math to solve problems, but we'll use physics to figure out the physical meaning of our solutions.

Algebra

$$x + 5 = 9$$
$$-5 \quad -5$$
$$x = 4$$

Algebra

B
E
D
M
A
S

$$3v + 5 = 17$$
$$-5 \quad -5$$
$$\frac{3v}{3} = \frac{12}{3}$$

$$v = 4$$

Algebra

$$T_k = T_c - 273.15$$

What is $T_c = $?

$$T_k = T_c - 273.15$$
$$+273.15 \qquad +273.15$$

$$T_k + 273.15 = T_c$$

Algebra

$$v = \frac{d}{t}$$

How do I find *d*?

What about *t*?

$$2 = \frac{4}{2} \qquad 5 = \frac{15}{3}$$

$$t \times v = \frac{d}{t} \times t$$

$$\frac{t \times v}{v} = \frac{d}{v} \implies t = \frac{d}{v}$$

Algebra

How do I find t?

What about v_f?

$$t \times a = \frac{v_f - v_i}{t} \times t$$

$$\frac{t \, a}{a} = \frac{v_f - v_i}{a}$$

$$t = \frac{v_f - v_i}{a}$$

Algebra

$$E_k = \frac{1}{2}mv^2$$

How do I find *m*?

What about *v*?