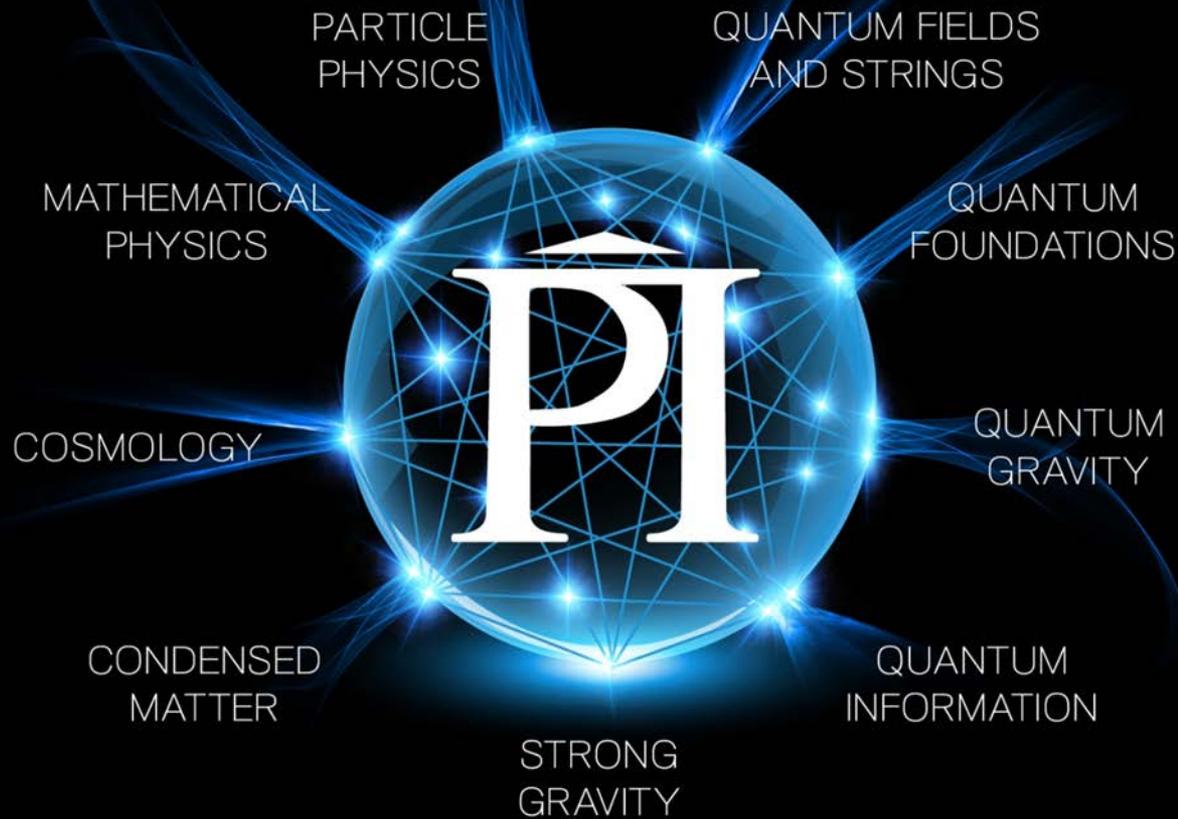


# Perimeter Institute for Theoretical Physics



How Do Scientists Think?



# All Known Physics

$$\Psi = \int e^{\frac{i}{\hbar} \int \left( \frac{R}{16\pi G} - \frac{1}{4} F^2 + \bar{\psi} i \not{D} \psi - \lambda \varphi \bar{\psi} \psi + |D\varphi|^2 - V(\varphi) \right)}$$

Schrodinger  
Feynman  
Planck  
Einstein  
Newton  
Maxwell-Yang-Mills  
Dirac  
Yukawa  
Kobayashi-Maskawa  
Higgs



# Classroom Resources

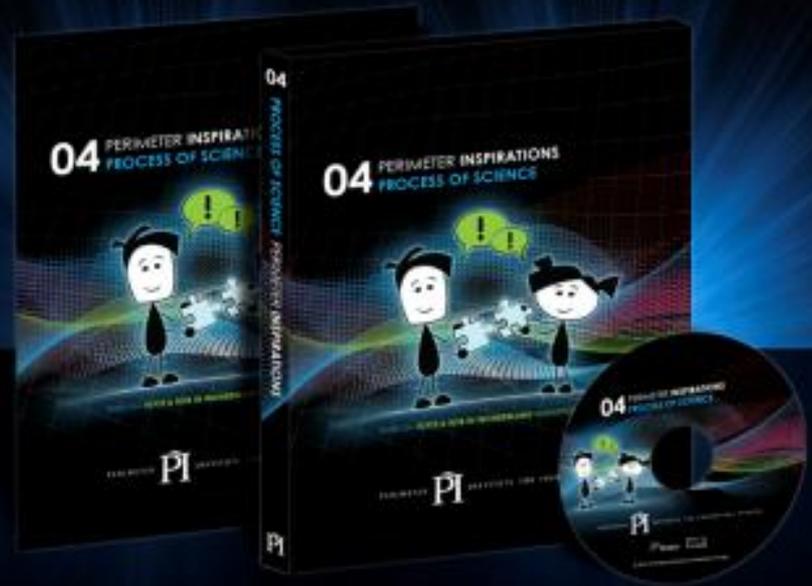
Beyond Particle Physics: Remodelling the Atom  
The Challenge of Quantum Reality  
The Mystery of Dark Matter

Process of Science

Revolutions in Science

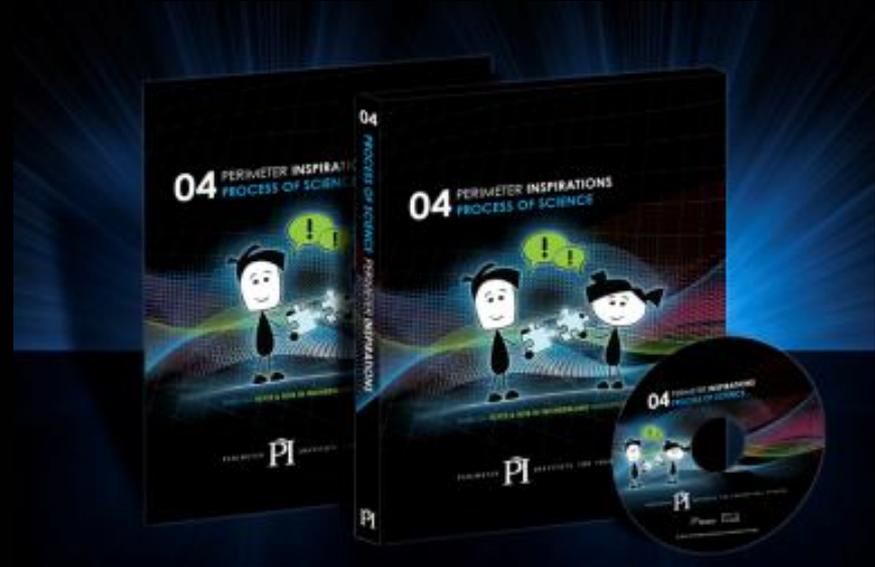
GPS and Relativity

Planck's Constant



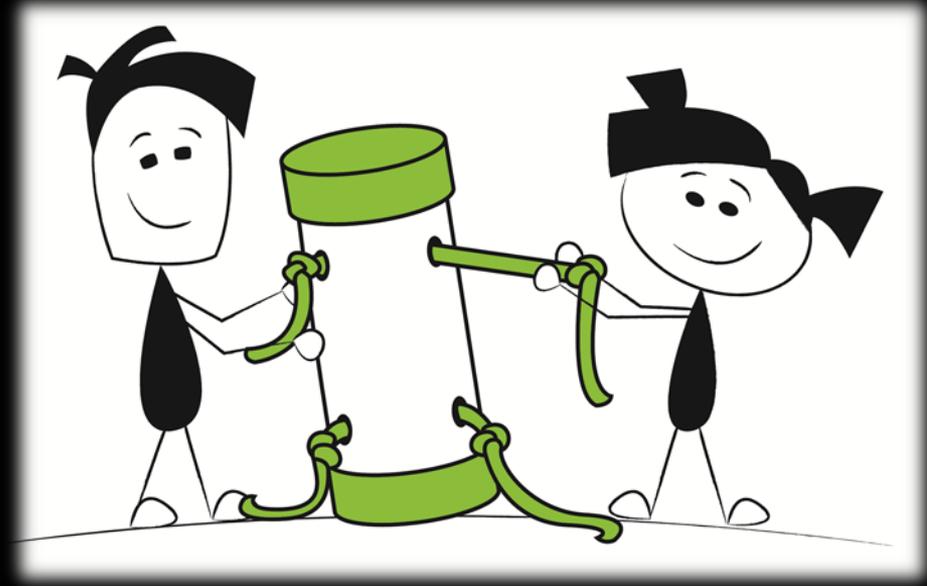
# The Process of Science

- Multimedia sampler
  - MinutePhysics, Alice&Bob
- 7 student activities
  - Grade 7 to 12
  - Hands-on
  - Editable format
- Supplementary Information



# How Do Scientists Think?

SCIENTISTS  
ARE CURIOUS



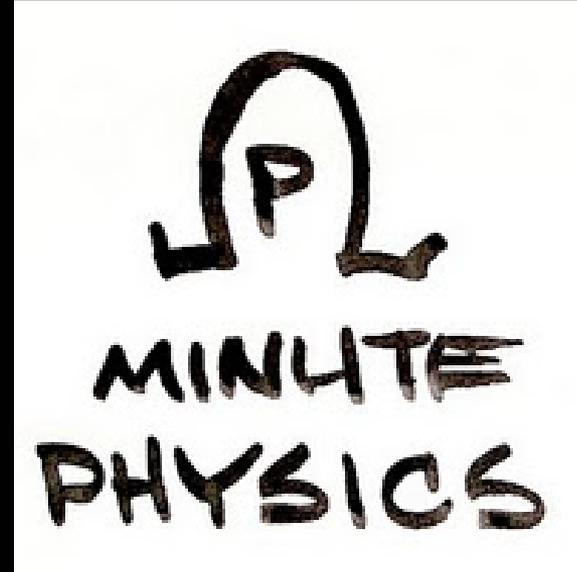
# How Do Scientists Think?

SCIENTISTS  
ARE CREATIVE

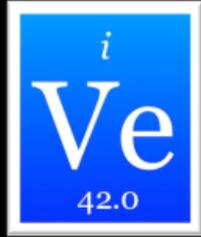


# MinutePhysics

- Created by Henry Reich  
PSI alumni  
Over 1 400 000 subscribers!
- One of a new breed of  
YouTube educators



# Some other YouTube channels to watch:



**Veritasium**  
an element of truth

**SIXTY Ψ SYMBΦLS**

Videos about the symbols of physics and astronomy

**Smarter**  
  
**Every Day**

**HEAD**  
**SQUEEZE**

Numberphile

# How Do Scientists Think?

SCIENTISTS  
ASK  
QUESTIONS

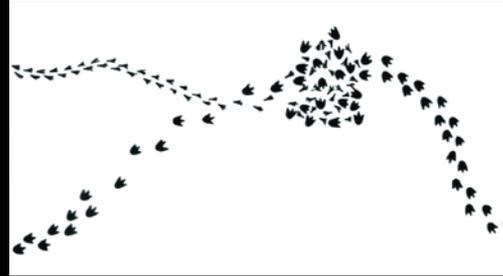


# How Do Scientists Think?

SCIENTISTS  
ASK  
QUESTIONS



# What Do You See?



# Why Is It Like That?



# Why do hot things glow?



# Is colour related to temperature?



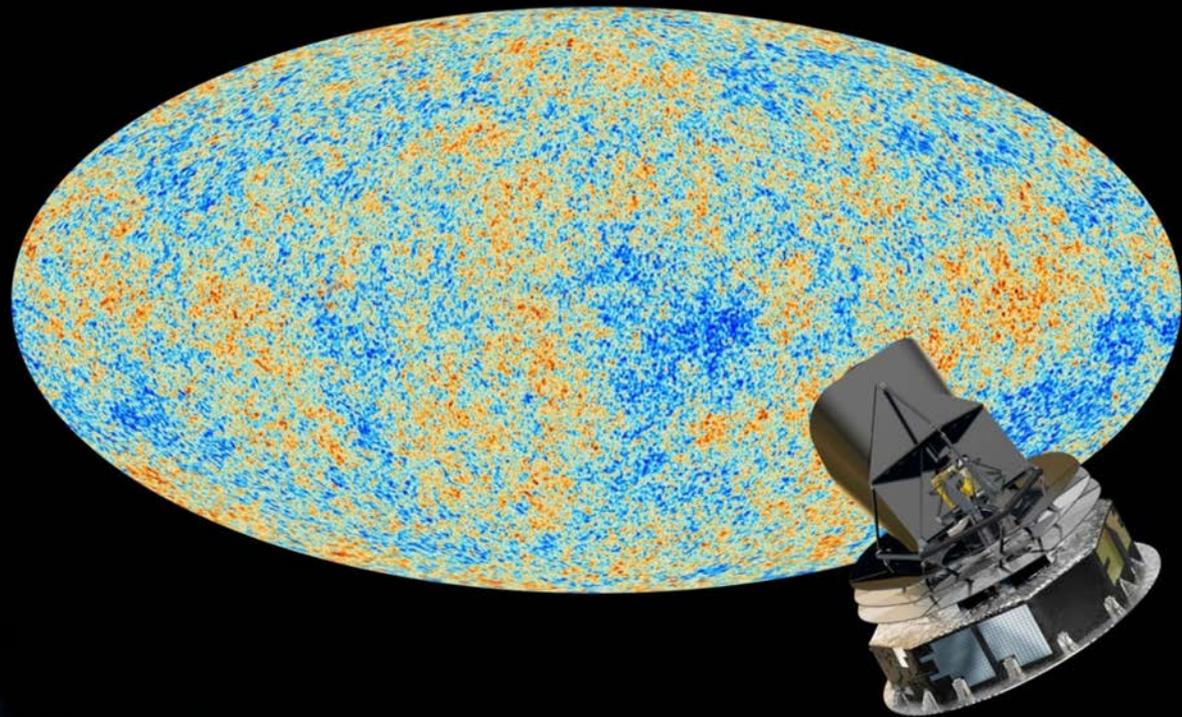
# YES!!



# How does this work?

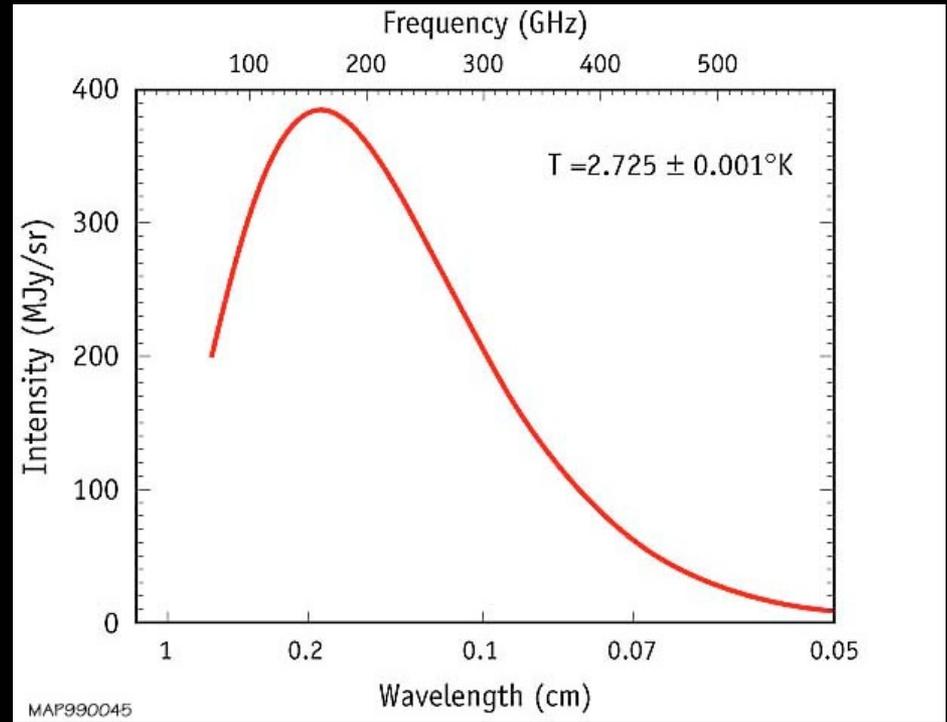


# What's new?



# What colour is the night sky?

This equates to  
a temperature  
of 2.725 K



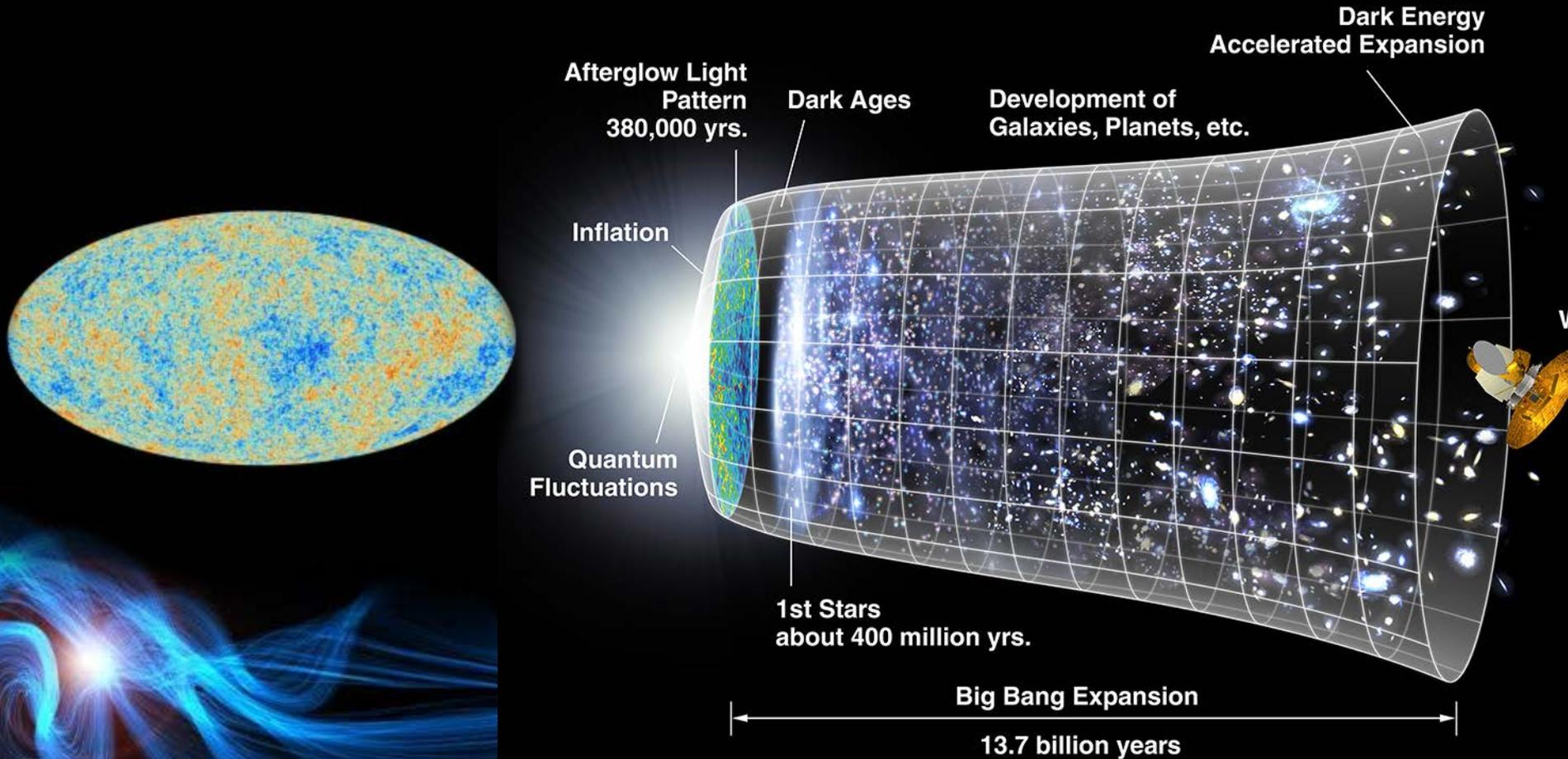
We know the temperature it is...

We know the temperature it was...

We can figure out how long the  
universe has been cooling for...



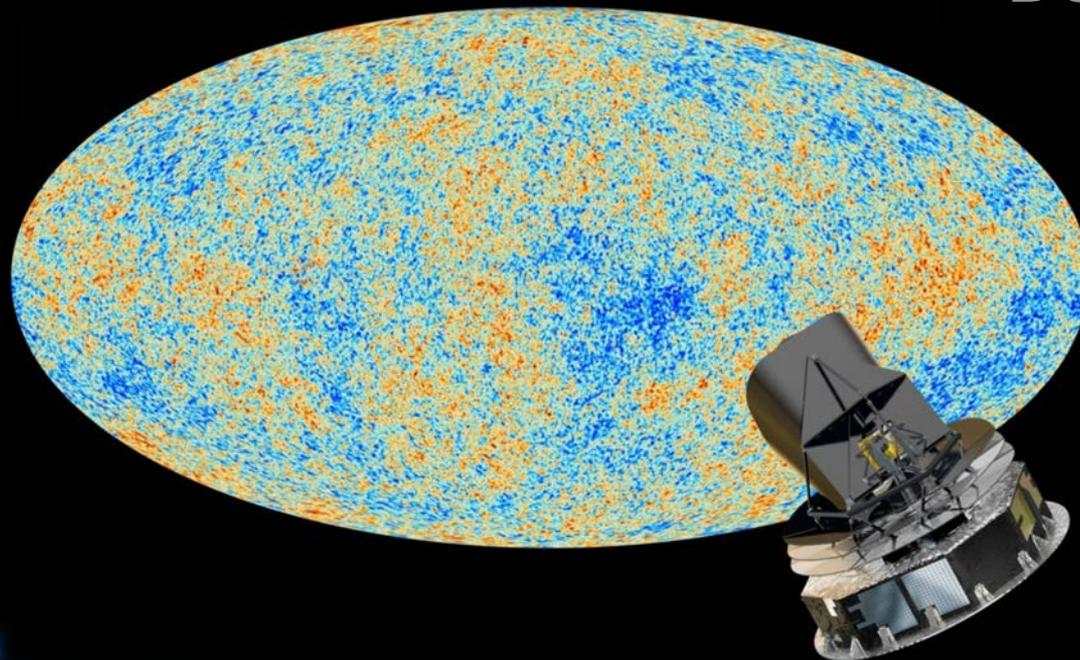
# The universe is 13.82 billion years old



Normal  
Matter  
4.9%

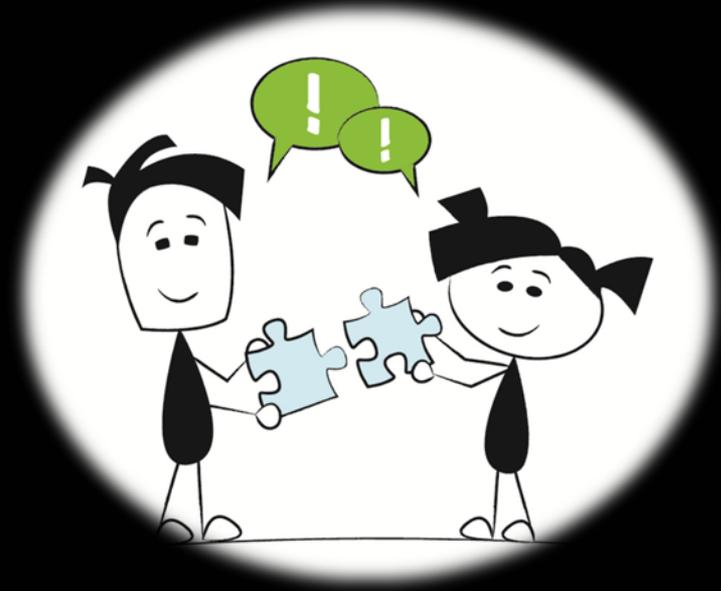
Dark Matter  
26.8%

Dark Energy  
68.3%



# How Do Scientists Think?

SCIENTISTS  
COLLABORATE



# Science in the News

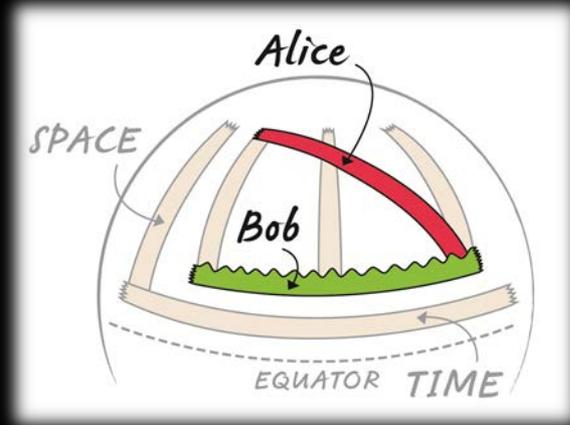
The OPERA experiment in Gran Sasso Italy has released data suggesting that neutrinos travel faster than light. How can this be?



# Science is a powerful way of thinking.



curiosity



creativity



collaboration

# Thank You!

[www.perimeterinstitute.ca](http://www.perimeterinstitute.ca)

Dave Fish  
dfish@pitp.ca  
@DaveFishPI 