Welcome to Where the Arts meet Physics

Course Website – Please Refer (Under Construction)
In the Beginning.....
Hymn of Creation, Rg Veda:

Nor aught nor naught existed; yon bright sky
Was not, nor heaven's broad woof outstretched above.
What covered all? what sheltered? what concealed?
Was it the water's fathomless abyss?
There was not death - hence was there naught immortal,
There was no confine betwixt day and night;
The only One breathed breathless in itself,
Other than it there nothing since has been.
Darkness there was, and all at first was veiled
In gloom profound, - an ocean without light.
The germ that still lay covered in the husk
Burst forth, one nature, from the fervent heat.
Then first came Love upon it, the new spring
Of mind - yea, poets in their hearts discerned,
Pondering, this bond between created things
And uncreated. Comes this spark from earth,
Piercing and all-pervading, or from heaven?
Then seeds were sown, and mighty power arose -
Nature below, and Power and Will above.

Who knows the secret? who proclaimed it here,
Whence, whence this manifold creation sprang? -
The gods themselves came later into being. -
Who knows from whence this great creation sprang? -
He from whom all this great creation came.
Whether his will created or was mute,
The Most High seer that is in highest heaven,
He knows it - or perchance e'en He knows not.

Translation – Max Muller

Poetry, Visual Arts, Photography

Hubble Images – Window into Cosmos, Time
**History of the Universe**

**STARGAZING LIVE**

**THE UNIVERSE THROUGH TIME**

**BIG BANG**

The Universe has expanded and cooled ever since.

**INFLATION**

**HIGH ENERGY PARTICLE REACTIONS**

**A FEW MINUTES**

**FIRST NUCLEI FORM**

**A FEW HUNDRED MILLION YEARS**

**FIRST GALAXIES AND STARS FORM**

**EXPANSION OF THE UNIVERSE BEGINS TO ACCELERATE**

**TIME**

**THE BEGINNING**

The Universe began 13.8 billion years ago with an event known as the Big Bang. Both time and space were created then.

**FRACTION OF A SECOND**

- Rapid expansion occurs during a fraction of a second.
- The hot and dense universe is smaller than a proton.

**1 SECOND**

- The first hydrogen atoms form.
- The universe cools enough for these atoms to form.
- First electrons and protons combine to form hydrogen.

**100 - 1000 SECONDS**

- Nuclei begin to form: helium, deuterium, and lithium are first.
- The expansion rate of the universe slows.
- The first neutral atoms (protons, neutrons, and electrons) form.

**300,000 YEARS**

- Matter begins to form stars and galaxies.
- The cosmic microwave background radiation is emitted from the early universe.
- The expansion rate is still slowing.
Fusion, Nuclear Power, Elements

They Might be Giants
Here Comes Science
Meet the Elements

Elements – Tom Lehrer
In the middle of all sits Sun enthroned. In this most beautiful temple could we place this luminary in any better position from which he can illuminate the whole at once? The Sun sits as upon a royal throne ruling his children — the planets which circle round him.

-Copernicus
Einstein's Enigma
or Black Holes in My Bubble Bath

C.V. Vishveshwara
Tillie's atom monologue.

He told me to look at my hand, for a part of it came from a star that exploded too long ago to imagine. This part of me was formed from a tongue of fire that screamed through the heavens until there was our sun. And this part of me—this tiny part of me—was on the Sun when it itself exploded and whirled in a great storm until the planets came to be.

[Lights start up.]
And this small part of me was then a whisper of the earth. When there was life, perhaps this part of me got lost in a fern that was crushed and covered until it was coal. And then it was a diamond millions of years later—it must have been a diamond as beautiful as the star from which it had first come.
Or perhaps this part of me became lost in a terrible beast, or became part of a huge bird that flew above the primeval swamps.
And he said this thing was so small—it this part of me was so small it couldn’t be seen—but it was there from the beginning of the world.

And he called this bit of me an atom. And when he wrote the word, I fell in love with it.

Atom.

Atom.

What a beautiful word.
Space Travel
The larger the orbit radius, the slower the rotation speed and the longer it takes to complete a circle.

\[
\frac{GM}{R^2} = \frac{m}{r^2} \left(\frac{v^2}{R}\right)
\]

\[
\frac{GM}{R} = v^2, \quad v = \frac{2\pi R}{T}
\]

Satellites: Low/Medium Earth Orbit, Geosynchronous
A medium Earth orbit (MEO) satellite travels at about 6500 miles/hour (1.8 miles/sec). A satellite in low Earth orbit (LEO) travels at about

A. 700 miles/hour
B. 5 miles/sec
C. 500 meters/sec
D. It depends a lot on its altitude
A satellite in low Earth orbit (LEO) is travelling at about

A. 700 miles/hour  
B. 5 miles/sec  
C. 500 meters/sec  
D. It depends a lot on its altitude

- 5 miles/sec at an altitude around 100 miles  
- Escape velocity: 7 miles/sec  
- Earth radius is 4000 miles  
- Spy satellites can only view a given area for about a minute
Cosmos and Film

- Solaris
- Star Trek
- Star Wars
- 2001: A Space Odyssey
- Gravity
International Space Station

Mike Hopkins from space
"Space Oddity"

Ground Control to Major Tom
Ground Control to Major Tom
Take your protein pills
and put your helmet on

Ground Control to Major Tom
Commencing countdown,
enines on
Check ignition
and may God's love be with you

[spoken]
Ten, Nine, Eight, Seven, Six, Five,
Four, Three, Two, One, Liftoff

This is Ground Control
to Major Tom
You've really made the grade
And the papers want to know whose
shirts you wear
Now it's time to leave the capsule
if you dare

This is Major Tom to Ground Control
I'm stepping through the door
And I'm floating
in a most peculiar way
And the stars look very different today

For here
Am I sitting in a tin can
Far above the world
Planet Earth is blue
And there's nothing I can do

Though I'm past
one hundred thousand miles
I'm feeling very still
And I think my spaceship knows which way to go
Tell my wife I love her very much
she knows

Ground Control to Major Tom
Your circuit's dead,
there's something wrong
Can you hear me, Major Tom?
Can you hear me, Major Tom?
Can you hear me, Major Tom?
Can you....

Here am I floating
round my tin can
Far above the Moon
Planet Earth is blue
And there's nothing I can do.

Homage to David Bowie
Chris Hadfield
“Out yonder there is an immense cosmos that stands before us like a great eternal riddle, at least partially accessible to our inspection and thinking. The contemplation of this cosmos beckons like a liberation”

- Albert Einstein