Welcome to
Exploring Quantum Science through the Arts

PHYS199 CHP

This Class and the next

- About this Course
- Meet and Greet, Reflections
- Exploring the Universe

In previous years…

- Team
- Format
- Projects
- Culminating Event 2017, 2024

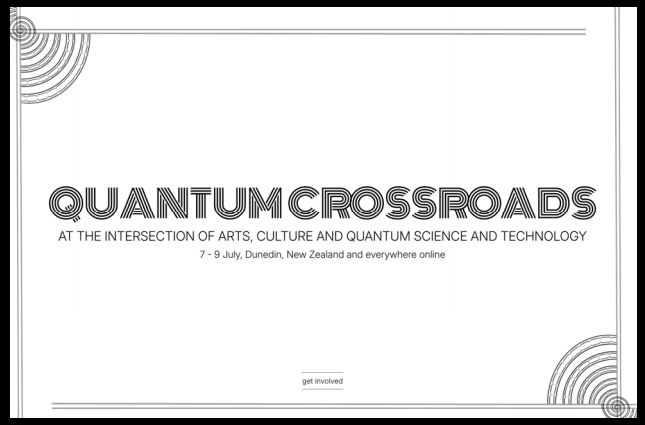
Course Website – (Under Construction)

INTERNATIONAL YEAR OF
Quantum Science and Technology

What Is IYQ?

Recognizing the importance of quantum science and the need for wider awareness of its past and future impact, dozens of national scientific societies gathered together to support marking 100 years of quantum mechanics with a U.N.-declared international year.

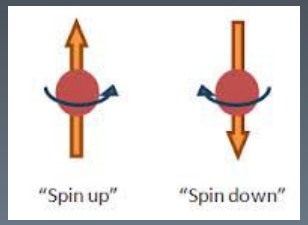
Global Events



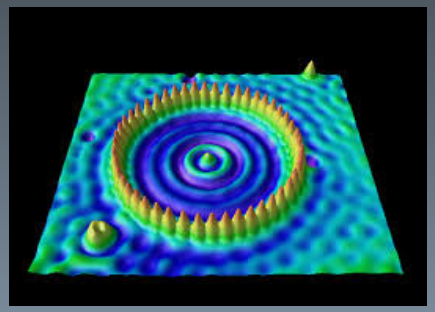
Quantum Voyages

QuantumFest, APS

The Universe; The Quantum World; Condensed Matter; High Energy

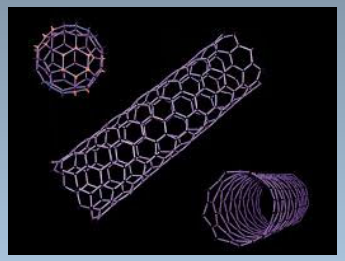


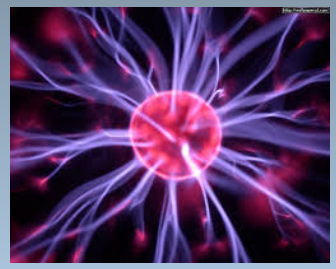
Quantum superposition
Does God play Dice?



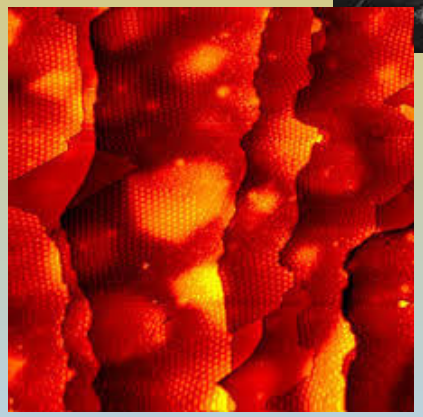
Matter Waves

Bizarre States of Matter

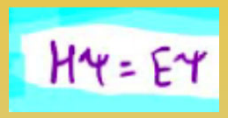


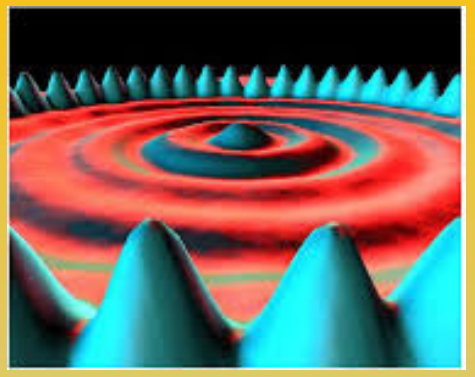


The Arts……



Quantum Voyages





[Latrelle Bright]

Synopsis: *Guided by Sapienza, the spirit of knowledge, two voyagers enter the microscopic realm of everyday human experience. As in epic and fairy tales, the voyagers explore land after land, each tickling the viewer's imagination and, unlike fairy tales, offering glimpses of a world we believe actually resides around us. The trio confront terrifying prospects of being Dead and Alive at once, encounter electrons acting as waves, are pelleted by photons, glide through diaphanous orbitals of atoms, precess in Magnetic Resonant Imaging machines, levitate above superconducting surfaces, and navigate disordered quantum within us and the affirmation that things are never what they seem.*


In the Beginning…..

Hymn of Creation, Rg Veda:

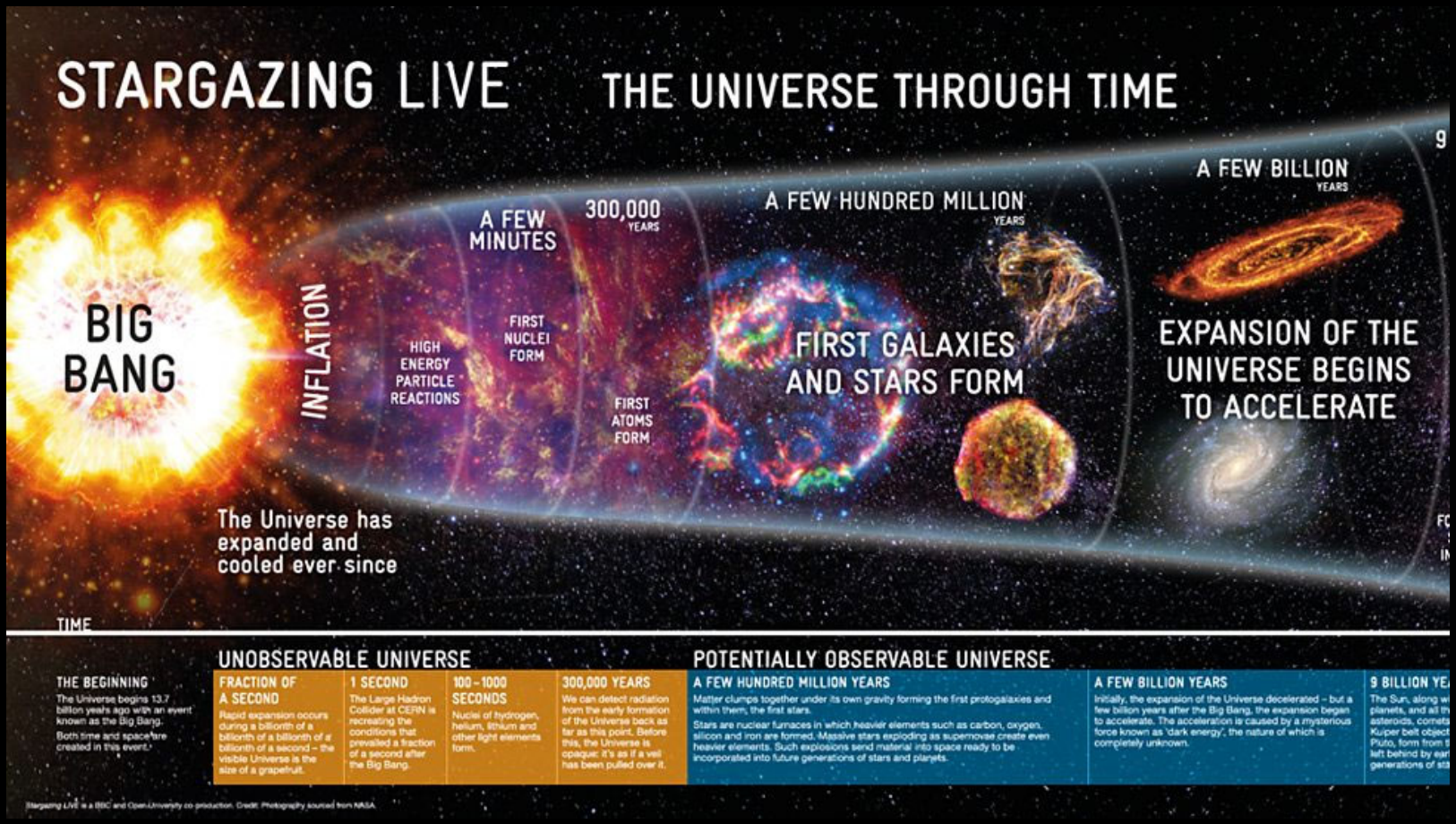
Nor aught nor naught existed; yon bright sky
Was not, nor heaven's broad woof outstretched above.
What covered all? what sheltered? what concealed?
Was it the water's fathomless abyss?
There was not death - hence was there naught immortal,
There was no confine betwixt day and night;
The only One breathed 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

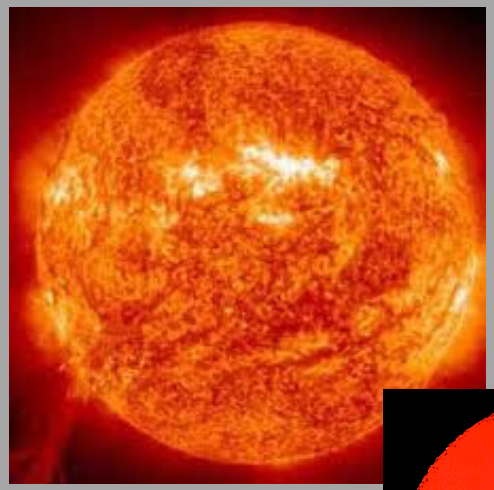
Poetry, Visual Arts, Photography

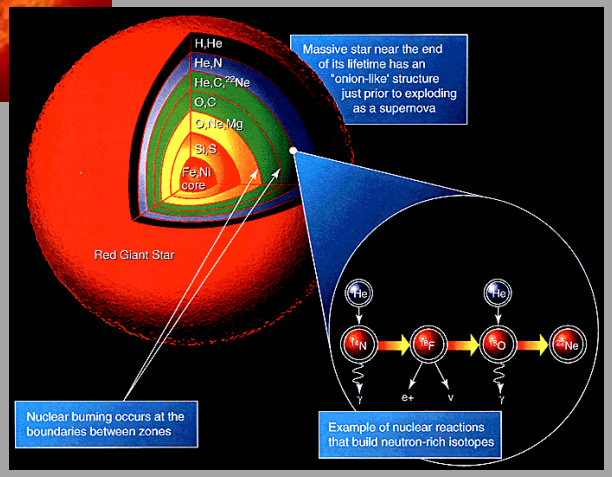
Hubble Images – Window into Cosmos, Time; James Webb

History of the Universe



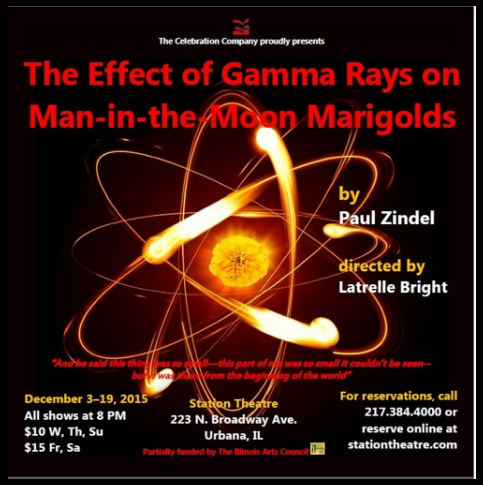
Fusion, Nuclear Power, Elements





[They Might be Giants](#)
[Here Comes Science](#)
[Meet the Elements](#)

[Elements](#) – **Tom Lehrer**



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 — 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.

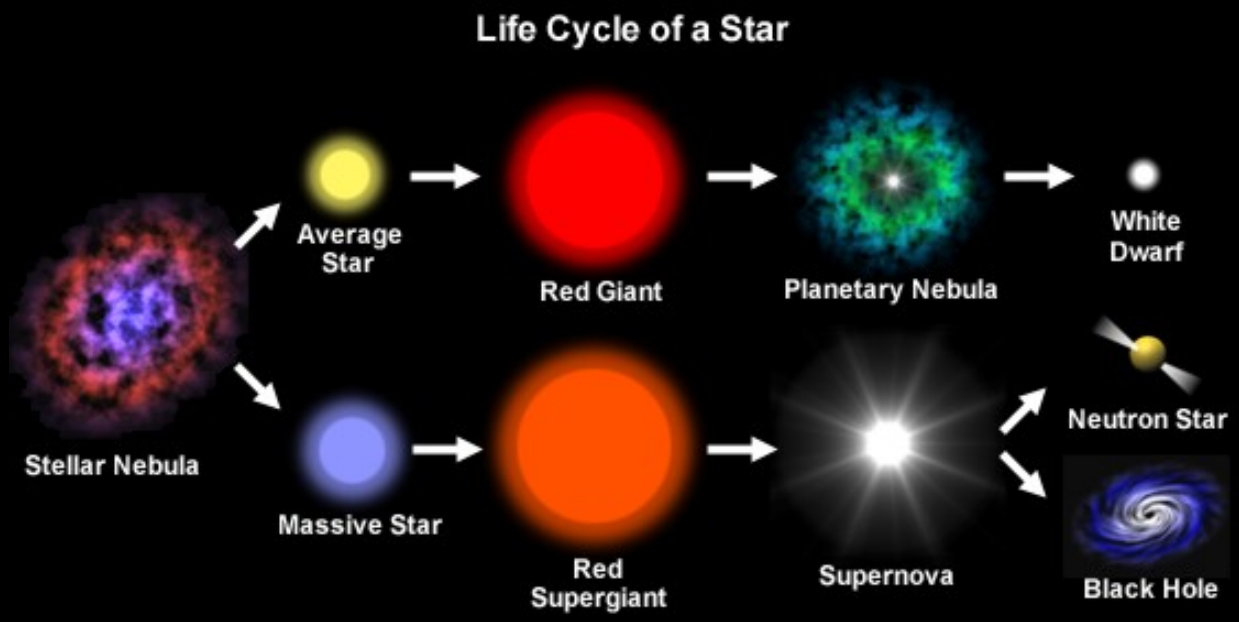
Atom.

Atom.

What a beautiful word.

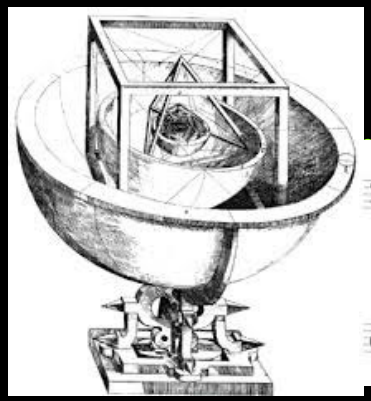
Also Spring of last year

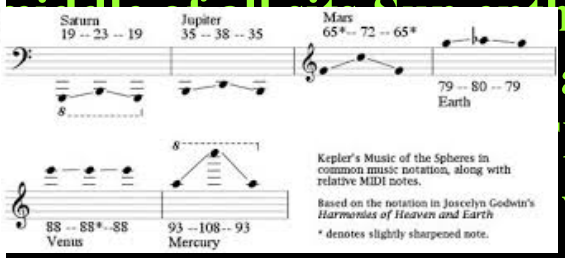
Stellar Life Cycle



Planets

Planetary Music





iddle of all sits Sun enthroned. In this most beautiful temple any better position from which he can he Sun sits as upon a royal throne which circle round him.

-Copernicus

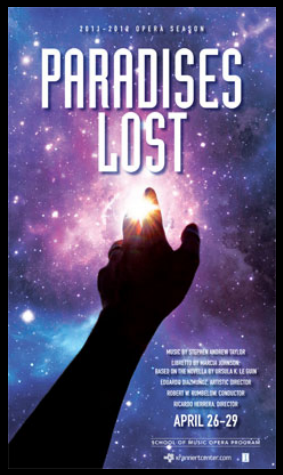
Gustav Holst-Planets-Mars

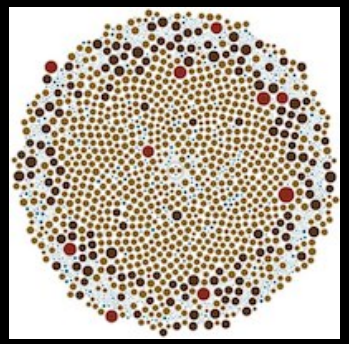
Total Solar Eclipse

From ancient myths to tests of general relativity to today……

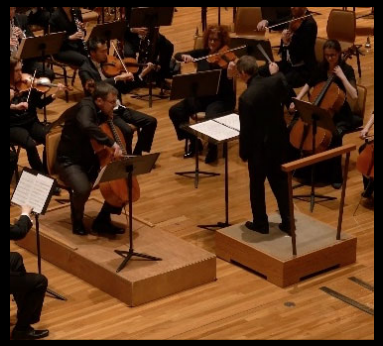
Last year--APRIL 8, 2024!!

Stephen Taylor—Music and Science





Exoplanets



Sunset in all directions
Celebrating the 2017 eclipse

Collaborations

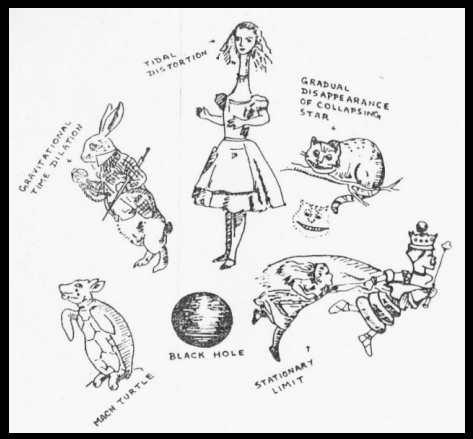
- *Solaria*
- *Joy of Regathering*

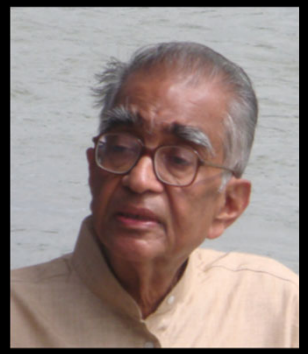
…….

Website

C. V. Vishveshwara

General Relativist, Black hole physicist, JNP Founder Director, Writer, Father….

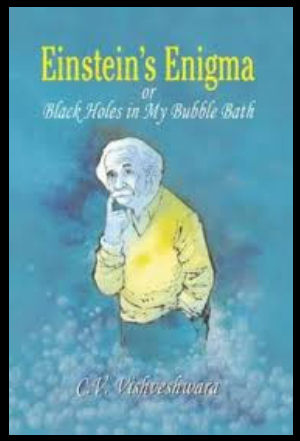




Recently:

Our Solar System (revived)

Gravity

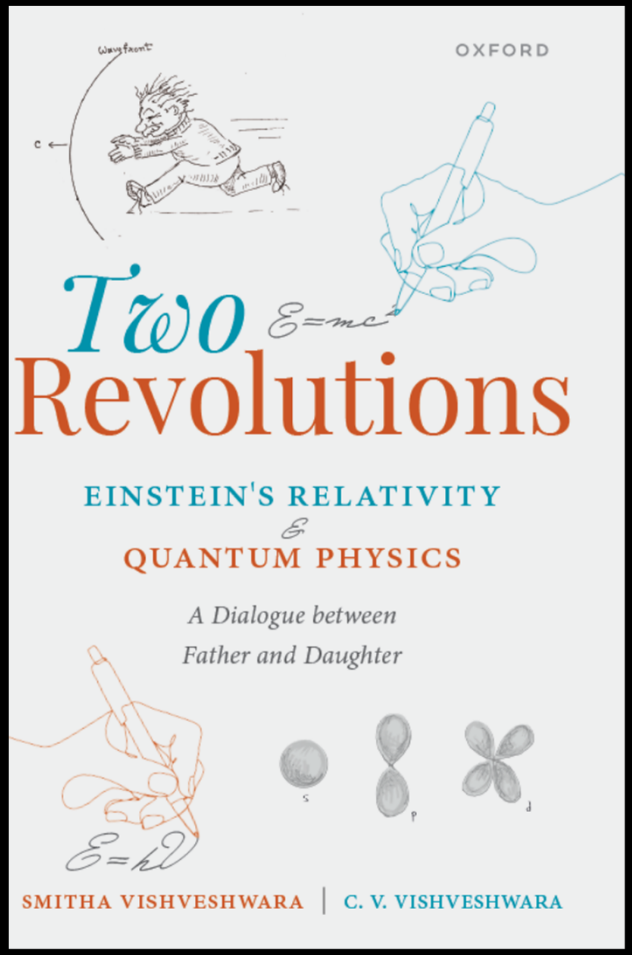


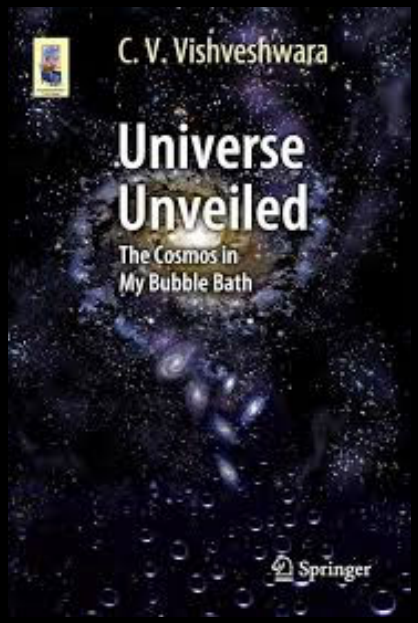
Vishveshwara Lectures

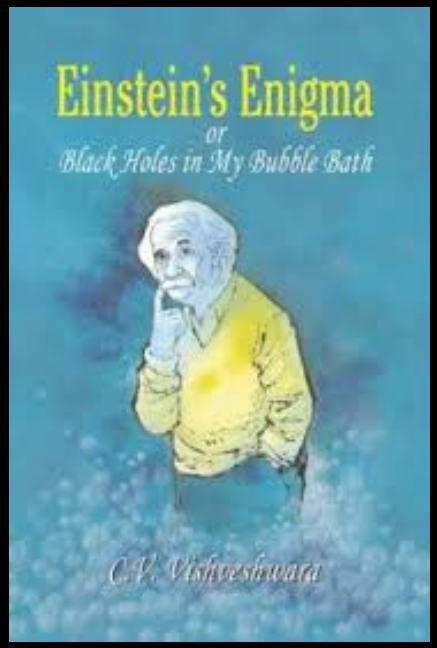
A PUBLIC LECTURE SERIES IN HONOUR OF BLACK HOLE PHYSICIST C. V. VISHVESHWARA

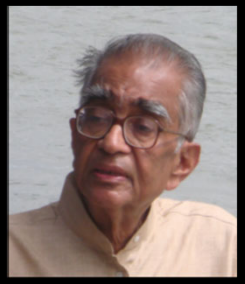
ICTS

INTERNATIONAL CENTRE *for* THEORETICAL SCIENCES





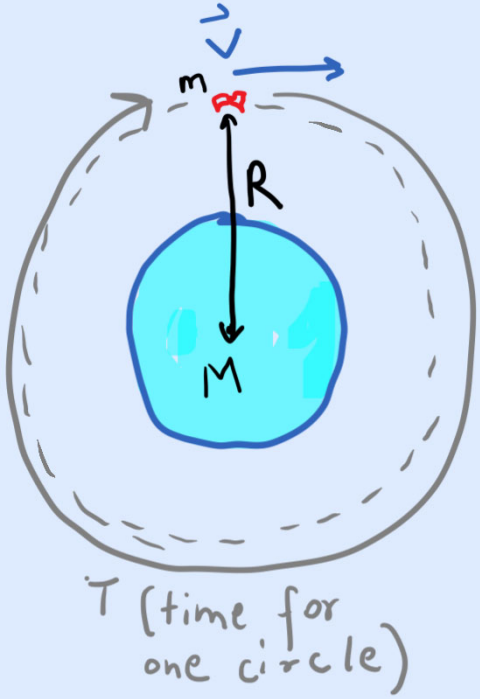




Book launch events:
UIUC April 2025: https://physics.illinois.edu/news/two-revolutions-debut
India July 2025: https://www.icts.res.in/outreach/other-events/cosmic-2025

Space Travel

Orbit distance, rotation rate, speed



The larger the orbit radius, the slower the rotation speed and the longer it takes to complete a circle

Details

$$F = ma$$

$$\frac{GmM}{R^2} = m\left(\frac{v^2}{R}\right)$$

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

Satellites: Low/Medium Earth Orbit, Geosynchronous

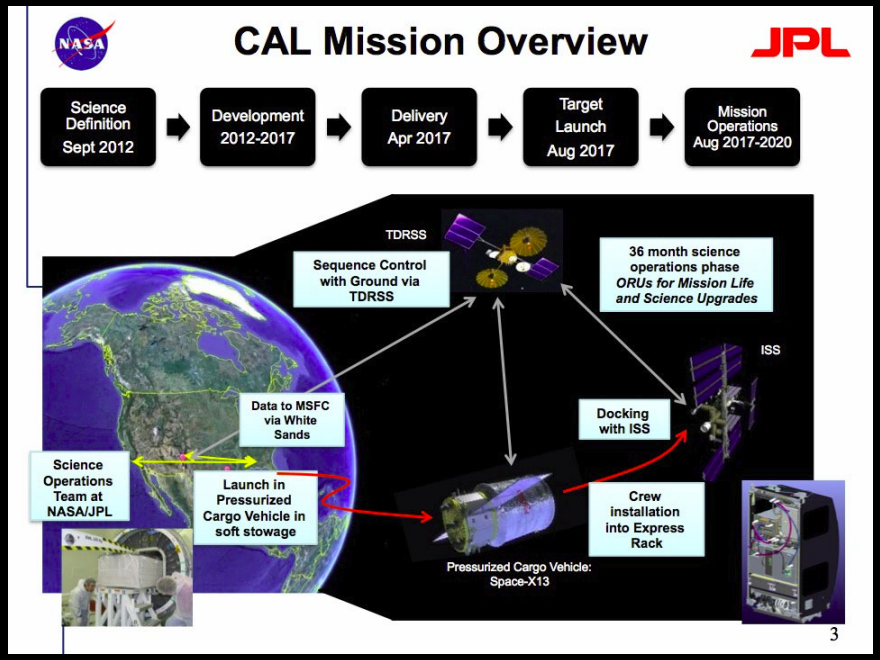
A medium Earth orbit (MEO) satellite travels at about 6500 miles/hour (1.8 miles/sec). A satellite in low Earth orbit (LEO) travels at about

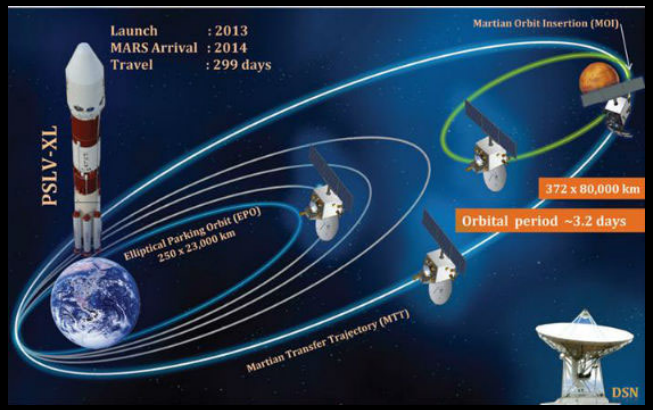
A. 700 miles/hour
B. 5 miles/sec
C. It depends a lot on its altitude

A satellite in low Earth orbit (LEO) is travelling at about

A. 700 miles/hour
B. 5 miles/sec
C. 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


CAL Mission Overview
JPL
Science Definition Sept 2012
Development 2012-2017
Delivery Apr 2017
Target Launch Aug 2017
Mission Operations Aug 2017-2020
TDRSS
Sequence Control with Ground via TDRSS
36 month science operations phase
ORUs for Mission Life and Science Upgrades
ISS
Data to MSFC via White Sands
Docking with ISS
Science Operations Team at NASA/JPL
Launch in Pressurized Cargo Vehicle in soft stowage
Crew installation into Express Rack
Pressurized Cargo Vehicle: Space-X13
3


Launch : 2013
MARS Arrival : 2014
Travel : 299 days
Martian Orbit Insertion (MOI)
PSLV-XL
372 x 80,000 km
Orbital period ~3.2 days
Elliptical Parking Orbit (EPO) 250 x 23,000 km
Martian Transfer Trajectory (MTT)
DSN


₹2000
RESERVE BANK OF INDIA
TWO THOUSAND RUPEES
₹2000
2016
दो हज़ार रुपये
स्वच्छ भारत
एक कदम स्वच्छता की ओर
भारतीय रिज़र्व बैंक
मंगलयान MANGALYAAN
₹2000

Cosmos and Film

2001: A SPACE ODYSSEY

International Space Station

Mike Hopkins talks to children 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,
engines 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

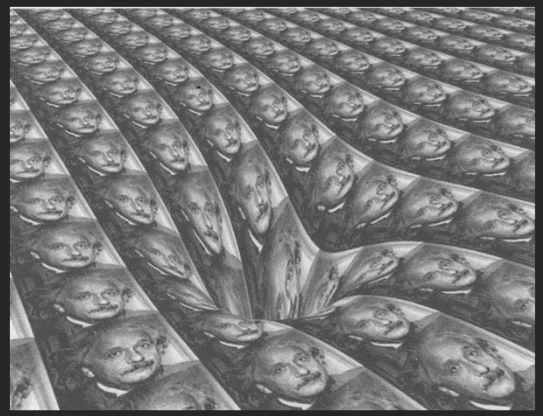
Though I'm past
one hundred thousand miles
I'm feeling very still
And I think my spaceship knows which way to go
Tell my wife I love her very much
she knows

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

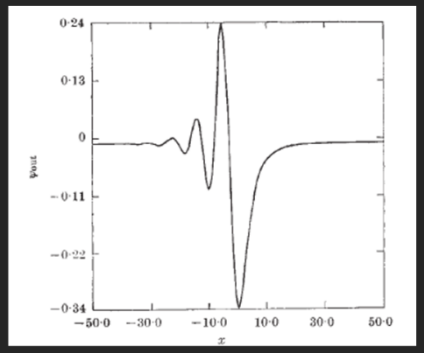
Discovery of Gravitational Waves!!!!



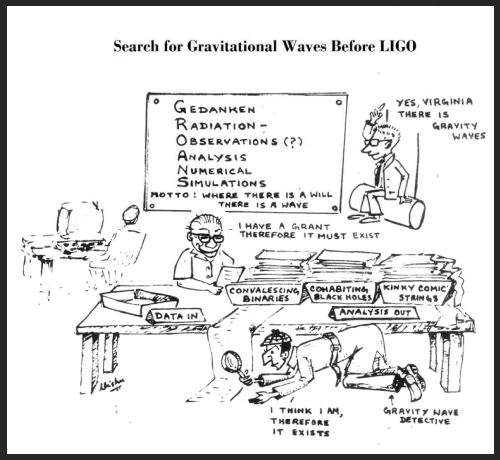
Space-time curvature

Feb 2016:

LIGO announces detection from two blackholes merging

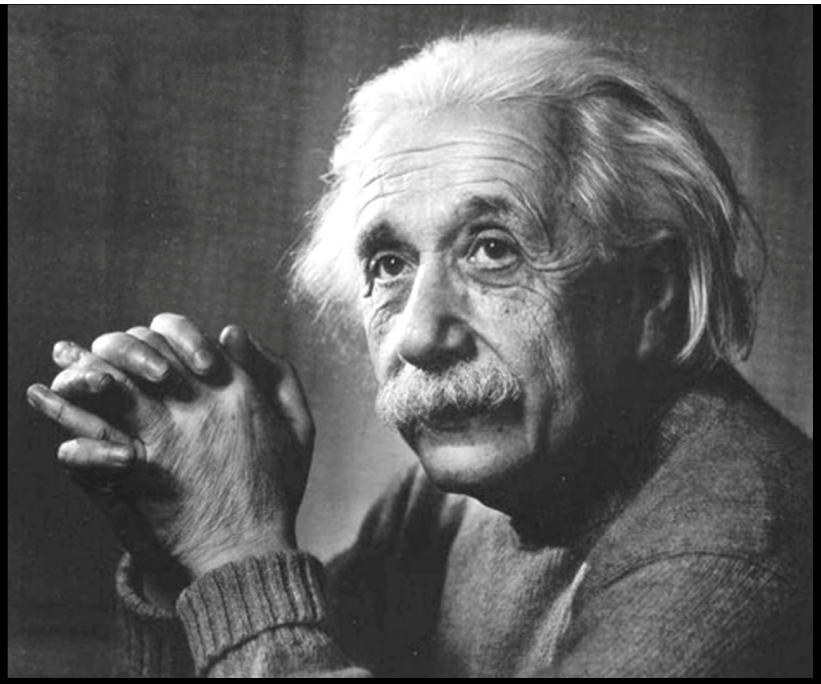


CVV – QNM '70; Cartoon



Universe in Motion

Kirstie Simson, Dance, CoLab



“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

Welcome to Where the Arts meet Physics

Cosmic Tumble, Quantum Leaps
APS March Meeting 2023

Forthcoming: 2025 International Year of the Quantum

Quantum Voyages, Quantum Rhapsodies, and more….