

Rod Lee's List of Astronomy & Physics Educational Resources Websites & Books

Hyperlinks	Description & Credit
Acoustics and Vibration Animations	Dan Russell's Acoustics and Vibration Animations (Pennsylvania State University) page provides excellent wave simulations for many different types of waves acs.psu.edu
AAPT	A professional membership association of scientists dedicated to enhancing the understanding and appreciation of physics through teaching. AAPT.org
AAPT - ComPadre	The AAPT ComPADRE Digital Library is a network of free online resource collections supporting faculty, students, and teachers in Physics and Astronomy Education
APOD	Astronomy Picture of the Day (NASA – back to the 1990s) apod.nasa.gov
Center for Astrophysics (Harvard & Smithsonian)	The Center for Astrophysics combines the resources and research facilities of the Harvard College Observatory and the Smithsonian Astrophysical Observatory under a single director to pursue studies of those basic physical processes that determine the nature and evolution of the universe.
Crash Course (Physics)	Fast-paced ten minute introductions to various topics in physics (more conceptual than mathematical, although many formulae are shown) https://youtube.com/playlist?list=PL8dPuuaLjXtN0ge7yDk_UA0ldZJdhwkoV
Einstein Online	This web portal provides information about Albert Einstein's theories of general and special relativity and their coolest applications, from the smallest particles to black holes, gravitational waves, and cosmology. https://www.einstein-online.info/en/
European Space Agency (ESA)	"ESA is the only space agency in the world that covers the whole range of space activities. We're exploring our Solar System and unlocking the secrets of the Universe. We're monitoring space and protecting our planetary environment. We're making space accessible and developing the technologies for the future, and we're also using space to benefit citizens and meet future challenges on Earth." (quoted from YouTube channel) https://www.esa.int/
Hubble Space Telescope (HST)	Videos from and about the Hubble Space Telescope (HST) https://www.nasa.gov/mission_pages/hubble/main/index.html
HyperPhysics	An online physics "textbook" with excellent explanations, video demonstrations, and concept mapping - there is also an index (for more linear minds) from which one may select topics in physics to study. There is also a HyperMath which covers math concepts through calculus. http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

Institute for Physics	The Institute of Physics is the professional body and learned society for physics in the UK and Ireland, inspiring people to develop their knowledge, understanding and enjoyment of physics. https://www.iop.org
Khan Academy (Physics)	Thorough conceptual and mathematical introductions to various topics including astronomy, math, & physics www.khanacademy.com
Kurzgesagt - In a Nutshell	Clever, concise videos about science - with a touch of optimistic nihilism https://youtube.com/inanutshell
Minute Physics	Short video explanations of all things physics https://youtube/user/minutephysics
MIT Online Physics Courses	Free undergraduate and graduate level physics courses taught at MIT with lecture notes, assignments, and exams with solutions https://ocw.mit.edu/courses/physics/
Volume I Volume II Volume III	A free, online (or downloadable PDF) physics with calculus textbook (in three parts) from OpenStax - a non-profit, educational initiative based at Rice University (They have many other subjects including chemistry, calculus, astronomy, and biology, as well as non-science topics) https://openstax.org/
oPhysics: Interactive Physics Simulations	Interactive Physics Simulations (simulations for virtually all of introductory physics) https://ophysics.com/index.html
PBS Chemistry & Physics	Thirty minute videos on a variety of topics in chemistry and physics https://opb.pbslearningmedia.org/
PBS Space Time	"Space Time explores the outer reaches of space, the craziness of astrophysics, the possibilities of sci-fi, and anything else you can think of beyond Planet Earth with our astrophysicist host: Matthew O'Dowd." (quoted from the YouTube channel) https://youtube.com/c/pbsspacetime
PhET Simulations	Dozens of interactive simulations in physics via HTML 5 - many other areas of science and math topics as well (chemistry, biology, etc.) https://phet.colorado.edu/
Physics & Our Universe (The Great Courses)	<i>under construction</i>
Institute for Physics	Online course for adult learners that explores the frontiers of physics with videos, interactive simulations, and comprehensive notes (Harvard Smithsonian Center for Astrophysics) https://www.iop.org/explore-physics#gref
PhysLink	Comprehensive physics and astronomy online education, research and reference web site founded in 1995 by a physicist Anton Skorucak (Includes educational resources, humor , lists of constants, resources, news, and the ability to ask experts questions about physics) physlink.com
Richard Feynman: Fun to Imagine Videos	Ten minute video clips by legendary physicist Richard Feynman (in his home by the BBC)

SciShow Space	Short videos that explore the universe a few minutes at a time https://youtube.com/c/scishowspace
Science at NASA	Current videos on what NASA is doing and where they are going https://youtube.com/user/ScienceAtNASA
TED Talks (Education)	Ted Talks geared toward learning multiple subjects https://youtube.com/teded
The Physics Classroom	An online, somewhat interactive physics textbook covering many topics in introductory physics https://www.physicsclassroom.com/
The Particle Adventure	An award winning interactive tour of quarks, neutrinos, antimatter, extra dimensions, dark matter, accelerators and particle detectors from the Particle Data Group of Lawrence Berkeley National Laboratory https://particleadventure.org
The Physics Hypertextbook	An online, calculus based, interactive physics textbook covering mechanics, thermal physics, waves and optics, electricity and magnetism, and modern physics. https://physics.info/
Yale Courses	Free undergraduate and graduate courses on all sorts of topics https://youtube.com/user/YaleCourses

Book Recommendations (1 to 5, where 1 is low and 5 is high)

Book	Author	Difficulty	Enjoyment
A Brief History of Time	Stephen Hawking	2	4
Bad Astronomy (picks apart conspiracy theories like the Apollo mission was filmed in the desert)	Philip Plait	1	5
Before the Big Bang	John Gribbin	2	4
Billions & Billions	Carl Sagan	1	4
Black Holes & Time Warps	Kip Thorne	2.5	5
Cosmos	Carl Sagan	2	5
Cosmology for the Curious	Delia Perlov	4	5
Galileo's Daughter (a series of letters Galileo's daughter wrote to him from the monastery)	Dana Sovel	1	4
Hyperspace: A Scientific Odyssey Through Parallel Universes, Time Warps, and the Tenth Dimension	Michio Kaku	2	5

Mr. Tomkins (a fun read about a place where the speed of light is near slow driving speed and Planck's Constant affects macroscopic everyday items)	George Gamow	2	5
Our Mathematical Universe: My Quest for the Ultimate Nature of Reality	Max Tegmark	2.5	4
Pale Blue Dot	Carl Sagan	1	4
Science: A History	John Gribbin	1	4
The Glass Universe: How the Ladies of the Harvard Observatory Took the Measure of the Stars	Dava Sobel	1	4
The Goldilocks Enigma: Why is the Universe Just Right for Life	Paul Davies	2	5
The Grand Biocentric Design (explore consciousness & quantum physics)	Robert Lanza, MD	2	4
This Will Make You Smarter (New Scientific Concepts to Improve Your Thinking)	1-5 page entries by today's logical thinkers	2	4
Time Travel in Einstein's Universe	J. Richard Gott	3	5
Understanding the Universe: From Quarks to the Cosmos	Don Lincoln	3	5
Welcome to the Universe	DeGrasse Tyson, Gott, & Strauss	2	5

I should also mention that I subscribe to *The Great Courses Plus* which is \$19.95 per month but I watch lectures on everything from science to history almost daily. It's an app for phones/tablets, and you can use it in a web browser on a PC/Mac/Smart TV with a web browser.

Some excellent streaming series are as follows:

- Cosmos (the original by Carl Sagan) or Cosmos (new one by Neil deGrasse Tyson – Hulu)
- Cosmos: Possible Worlds (Hulu)
- How the Universe Works (quite up to date – Amazon Prime)
- PBS Nova (Amazon) has lots of space-related episodes
- The Universe (a little dated, but good – Amazon Prime)

Resources from PHY 12X classes:

- [100,000 Stars](#)
- [Astronomy Magazine News](#)
- [Astronomy Picture of the Day \(NASA\)](#)
- [Astronomy Simulations at University of Nebraska](#)
- [Clear Skies Charts in Oregon](#)
- [Crash Course: Astronomy](#)
- [Exoplanets Data Explorer](#)
- [Hertzsprung-Russell Diagram Simulator](#)
- [HubbleSite: Tonight's Sky Maps \(videos\)](#)
- [In the Sky](#) (Guides to the Night Sky)
- [JPL's What's Up Monthly Broadcast](#)
- [NASA Eclipse Website](#)
- [Night Sky Maps \(easily printable monthly sky maps\)](#)
- [Miscellaneous \(lots!\) of Useful Astronomy Resources](#)
- [Moon Atlas](#)
- [Sky & Telescope's Observing News & Current Celestial Events](#)
- [Sky & Telescope's Telescope Guides to Buying](#)
- [Stellarium \(Free Planetarium Software\)](#)
- [The Electric Universe \(University of Oregon\)](#)
- [The Solar System to Scale \(in the desert\)](#)
- [The Symphony of Science \(nothing like auto-tuned science videos!\)](#)