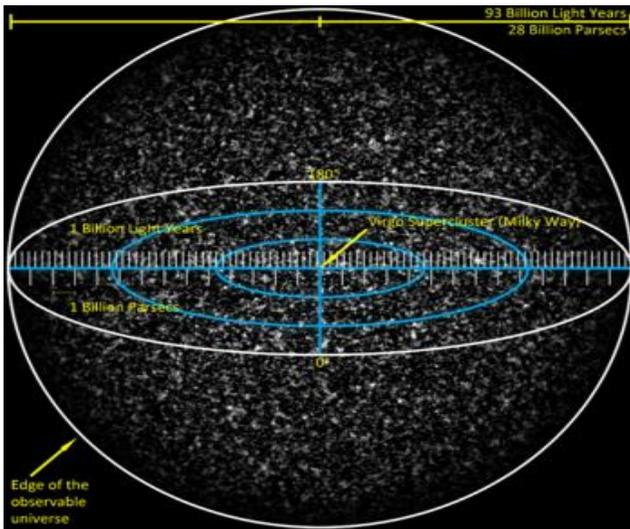


# KINEMATICS

Units 4 & 5 Dr. John P. Cise, Professor of Physics, Austin Community College, 1212 Rio Grande

St., Austin Tx 78701 [jpcise@austincc.edu](mailto:jpcise@austincc.edu) & NYTimes November 2, 2011 by Dennis Overbye. Please send a e-mail to Dr Cise on how you used this Physics application from the NYTimes. Thanks! DR Cise



**INTRODUCTION:** At left you can see the Universe is About 46 Billion ( $10^9$ ) light years in radius. It is estimated to Be about  $400 \times 10^9$  galaxies in the universe. A light year is the distance traveled by light in one year at 186,000 miles/s. **QUESTIONS:** (a) Find distance traveled by light In one year in miles? (b) Find volume of universe in (light years)<sup>3</sup>? (c) Find volume of universe in (miles)<sup>3</sup>? (d) Assuming uniform spacing between galaxies, how much volume (in light years)<sup>3</sup> & (miles)<sup>3</sup> of space does each galaxy occupy? **HINT:**

Volume of sphere =  $\frac{4}{3} (\pi) r^3$  ,  $X = V t$

**ANSWERS:** (a)  $5,866 \times 10^{12}$  miles (b)  $4.21 \times 10^{32}$  (light years)<sup>3</sup> (c)  $8.5 \times 10^{70}$  miles<sup>3</sup> (d)  $1.0525 \times 10^{23}$  (light years)<sup>3</sup>/galaxy ,  $2.12 \times 10^{59}$  miles<sup>3</sup>/galaxy

## Empty Times Square Is Fantasy; The Stranger Stuff Is Science

You might want to think twice, if you cherish your notions of reality, before accepting a ride from Brian Greene.



"The Fabric of the Cosmos," with Brian Greene, uses visual tricks to illustrate quantum paradoxes.

Step into a taxi, a Jeep, a [space shuttle](#) or even onto an escalator with this boyish Columbia University physicist and best-selling author, and you may soon find your watch acting weirdly, the landscape outside turning into a funhouse mirror or the uniqueness of your own identity called into question. So it goes, over and over again, in the course of "[The Fabric of the Cosmos](#)," a four-part tour of the universe that begins on "Nova" on [PBS](#) on Wednesday. Hosted by Dr. Greene, it is based on his 2003 book of the same title. **Our universe, with its hundreds of billions of galaxies**

**spread out over billions of light years, might be only an infinitesimal fraction of all that exists in a nearly endless sea of unreachable bubble universes.** That idea, which solves a lot of problems —

including that [dark energy](#) prying our own cosmos apart — has caused bitter strife among physicists, some of whom think it is a betrayal of Einstein's dream of a single theory of nature.

But Steven Weinberg, a Nobel laureate from the University of Texas, Austin, says, "There are no principles built into the laws of nature that say that theoretical physicists have to be happy."