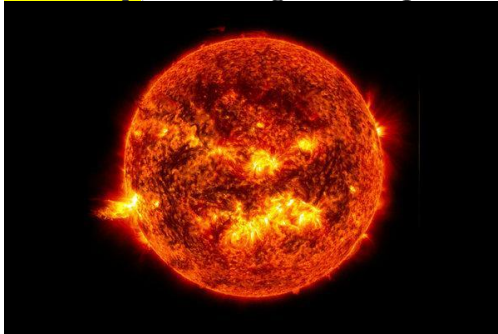


CENTRIPETAL FORCE FROM GRAVITY

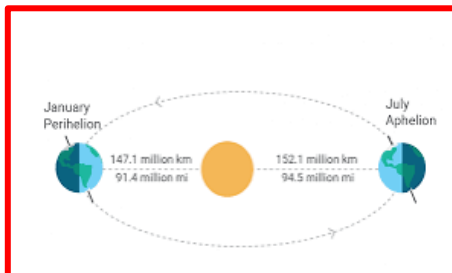
Unit 14, Dr. John P. Cise, Professor of Physics, Austin Com. College, Austin ,Texas ,USA, jpcise@austincc.edu & NYTimes, 7/5/18 by Shannon Hall

Never Mind the Summer Heat: Earth Is at Its Greatest Distance From the Sun

During aphelion, **our planet receives 7 percent less sunlight** than in **January**, but changes in the planet's orbit are not what causes our seasons.



Sweltering temperatures on the surface of Earth's northern hemisphere notwithstanding, the sun and Earth are currently three million miles farther from each other than when they're closest.



INTRODUCTION start: Not only does gravity vary inversely as square of distance from object causing gravity, but also the intensity(I) of sunlight varies as inverse square of distance from source of light energy.

INTRODUCTION (con.): Thus, in case of earth at aphelion :
 $I(a) = C(\text{constant}) / (94.5 \text{ M miles})^2 = [0.00011978947] C$ and at perigee:
 $I(p) = C / (91.4 \text{ M miles})^2 = [0.000119703709] C$
Thus, the % decrease in intensity of light in the summer as compared to the summer would be: $\{ I(p) - I(a) \} / I(p) \times 100 = \{ 0.000007747 \} / 0.000119703709 \times 100 = \sim 6.5 \%$. Thus, close to the - 7% summer earth light intensity in article.

On Friday, Earth will swing toward the outermost point in its orbit, known as **aphelion(94.5 M miles)**. You, me and everyone on the planet will be three million miles farther from the sun than when we are closest to

it **(Perigee = 91.4 M miles.)** The change occurs because our planet's orbit is not perfectly circular. Instead, it is squashed into an ellipse with the sun offset from the center — an effect that causes Earth to orbit to its farthest point every July and its innermost point, or perihelion, every January (the exact dates vary slightly from year to year). So, while record-breaking temperatures and raging wildfires in the Northern Hemisphere might lead you to believe the sun is punishingly close right now, remember that it is just the opposite. **In fact, the extra distance causes the amount of**

received sunlight to drop by 7 percent compared to January. But don't expect any relief from summer. Seasons on Earth are the product of changes in the amount of direct sunlight as the planet **tilts** toward and away from the sun — not its orbital path. It would take a much greater swing, so that the amount of received sunlight dropped significantly, in order to notice the difference. To consider what life would be like on a planet under these orbital circumstances, you only have to look as far as **Mars, whose elliptical orbit causes the amount of received sunlight to vary by as much as 31 percent over the course of the planet's year.**

"I find it amusing that the common misconception about Earth's seasons is actually true if you are on Mars," said David Grinspoon, an astrobiologist at the Planetary Science Institute. "School children on Mars will need to be taught differently."

QUESTIONS: Lets now check out the **31% of light reduction received on MARS over the course of a year** mentioned in the article due to difference of MARS perigee (1.3814 AU.....take AU as constant....AU = astronomical unit...distance between earth and sun) and aphelion(1.666 AU from NASA data on web).

Use the same methodology for proving 31% difference in MARS solar intensity as shown for the earth's 7% Difference in the upper right section of this page. Show all steps in finding the 31% difference in MARS intensity difference.