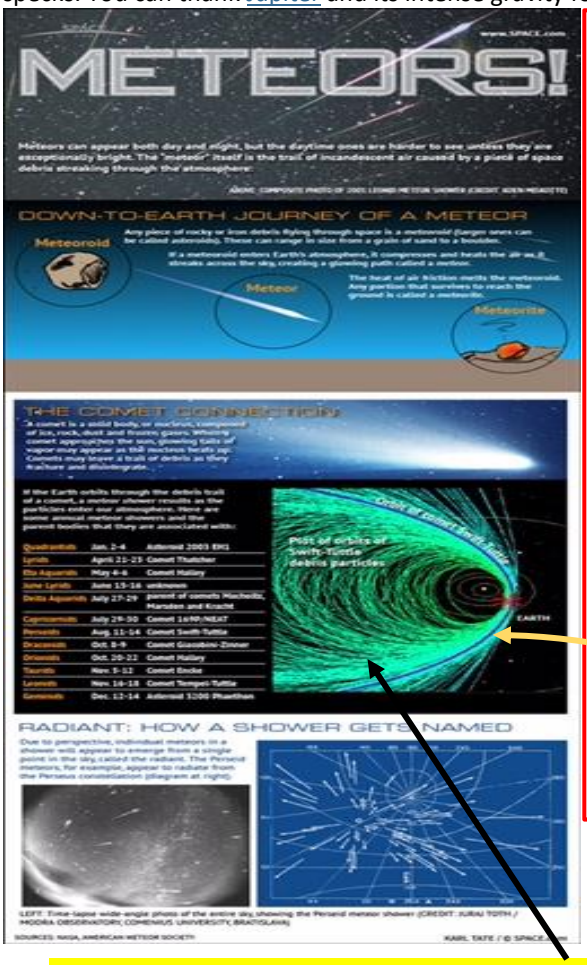
CENTRIPETAL FORCE FROM GRAVITY

Units 14 & 8 Dr. John P. Cise, Professor of Physics, Austin Com. College, Northridge Campus, jpcise@austincc.edu & NYTimes Aug. 10,2016 by Nick St. Fleur

---

Get Ready for the Perseids Meteor Shower: 'It Will Rival the Stars in the Sky.

This week, the annual meteor shower will illuminate the night sky with cosmic fireworks, creating a particularly dazzling display for skygazers across the Northern Hemisphere. NASA estimates that between 160 and 200 meteors will ignite in Earth's atmosphere every hour during the display's peak on Thursday night and Friday morning. Normally the shower has between 80 and 100 space specks. You can thank Jupiter and its intense gravity for turning this year's meteor shower into a meteor hurricane.



INTRODUCTION: **Goal with this application is to find mass of our sun knowing period(T) given below (133 years) of Comet Swift-Tuttle and from Wikipedia site the Swift-Tuttle semi-major axis(R) is 26.092 AU. Gravity(GmM/R^2) supplies the needed centripetal force for the comet in orbit around the sun. Thus, $G\,Mm/R^2 = m\,v^2/R$ where $v = r\,\omega$, $v = R\,2\pi f$, $v = 2\pi R/T$ since $f = 1/T$. Thus, $G\,M/R^2 = 4\pi^2R/T^2$ which when solved for…… $M = (4\pi^2/G)[\,R^3/T^2]$ called Kepler's 3rd. Law G = gravitational constant = 6.67×10^{-11} N $m^2/kg.^2$**

QUESTIONS: **(a)Convert R = 26.092 AU(astronomical Units) to meters? (b)Convert 133 years(T) into seconds? (c)Using Kepler's 3rd Law find the mass of our sun?, (d) How did the mass of sun found using Swift-Tuttle R & T compare with NASA stats on mass of sun?**

HINTS: **1 AU = 1.5×10^{11} m., 365 days/year, 24 hrs./day, 3600 s./hr.**

ANSWERS: **(a) R = 3.914×10^{12} m. , (b) T = 1.7556×10^{19} s., (c) $M_{SUN} = 2.02 \times 10^{30}$ kg. , (d) NASA data shows $M_{sun} = 2.0 \times 10^{30}$ kg. Thus, computed M_{SUN} from Swift-Tuttle R & T comes very very close To NASA stated M_{SUN} .**

COMMENT: **Comet Swift-Tuttle ,which left debris behind floating in the solar system, was last scene in 1862,1479, and 1079.**

The ***Perseids occur when Earth runs into pieces of debris floating in the solar system that were left behind by*** **Comet Swift-Tuttle. The 17-mile-wide dirty snowball orbits the sun about once every 133 years.** It made its last close pass by the sun in 1992. But you won't be seeing the leftovers of that event. A general rule of thumb with meteor showers is that you are never watching remnants from a comet's most recent orbit. Instead, the burning bits come from the previous pass. In this case, the debris were ejected when Comet Swift-Tuttle visited in 1862 or earlier. For this week's shower, Jupiter's gravity has tugged together at least three meteor streams left by the comet into Earth's path. Our planet will run into a cluster of leftovers from Comet Swift-Tuttle's rendezvous in 1862, 1479 and 1079. The Perseids in 2015, seen from Switzerland. They zoom through the atmosphere at around 133,000 miles per hour and burst about 60 miles overhead. "You're seeing pieces of ice that have been orbiting for that long kamikaze-ing themselves into the Earth's atmosphere," said Bill Cooke, an astronomer with NASA's Meteoroid Environment Office.

Jupiter's large gravitational pull is constantly influencing the meteor streams, according to Dr. Cooke. Sometimes it tugs them toward Earth, and sometimes it pushes them farther away. The last time a special Perseids shower like this one occurred was in 2009.The Perseids zoom through the atmosphere at around 133,000 miles per hour and burst about 60 miles overhead, according to Dr. Cooke. Most of the meteors are about the size of a grain of sand, but some can be as large as a silver dollar. You should be able to see many of the small bursts, but it's the handful of large ones that create jaw-dropping fireballs when set ablaze.