CENTRIPETAL FORCE FROM GRAVITY

Units 14 & 8

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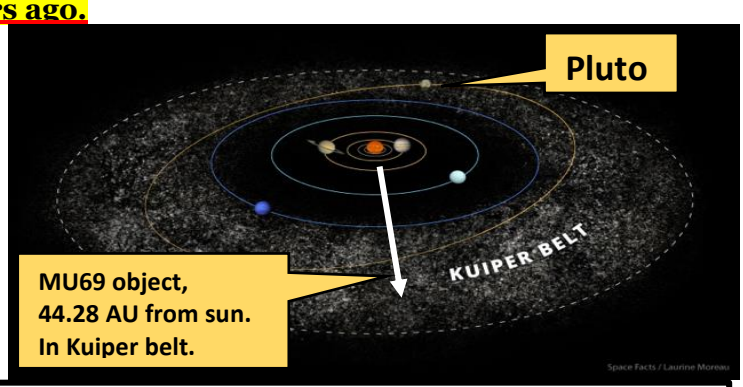
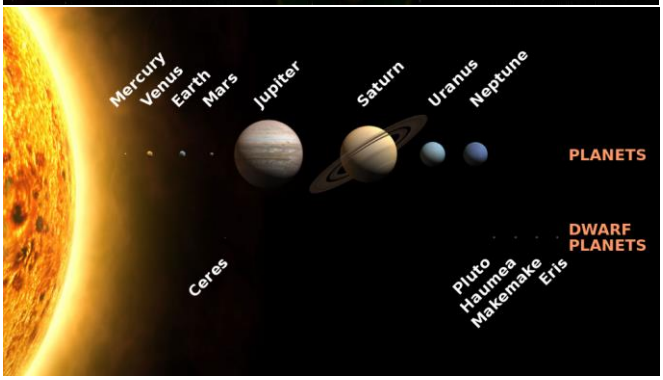
& New York Times, October 28, 2016 by Kenneth Chang

No More Data From Pluto

Most of the scientific investigations of Pluto by NASA's New Horizons spacecraft took place over the course of a single day, when it zipped within 8,000 miles of the dwarf planet in July of last year. Getting all that information back to Earth where scientists could study it took 15 months. **The New Horizons team is already planning for its next encounter on New Year's Day in 2019, passing within 2,000 miles of a distant clump of rock and ice known as 2014 MU69.** So far, astronomers do not know much about 2014 MU69 beyond that it is tiny and red — redder than Pluto though not quite as red as Mars — and that **it is part of what is known as the classical Kuiper belt, a disk of icy bodies beyond Neptune whose circular orbits appear undisturbed since the beginning of the solar system 4.5 billion years ago.**





INTRODUCTION: **Purpose of this application is to find mass of our sun this MU69 object orbits with Wikipedia/NASA data of: T(period) = ~ 295 yrs. , semi major axis R = 44.28 AU, AU = astronomical unit(distance earth-sun = 1.496 X 10^{11} m.) Equating gravity (Newton's 4th Law) to centripetal force:**

$G\,m\,M_S / R^2 = m\,v^2 / R$ where $v = 2\pi / T$ yields

$$M_S = (4\pi^2/G)(R^3/T^2)$$

QUESTIONS: (a) Find period in seconds? (b) Find R in meters?, (c) Find mass of sun using T & R of MU69?

HINTS: 365 days/yr., 24 hrs./day, 3600 s./hr., G = gravitational constant = 6.67 X 10^{-11} N m^2/ $kg.^2$

ANSWERS: (a) T = 9.303 X 10^9 s., (b) R = 6.624 X 10^{12} m., (c) 1.987 X 10^{30} kg. = M_{SUN}

COMMENT: NASA says mass of sun is 1.989 X 10^{30} kg.. Thus, using T & R of this distant Kuiper belt object works well.

An artist's conception of t ?he **New Horizons spacecraft flying past a distant Kuiper belt object.**

"We believe that **they are the primordial remnants of the disk that formed the planets**," Amanda M. Zangari, a researcher at the Southwest Research Institute in Boulder, Colo. working on the New Horizons mission, said during a news conference last week. S. Alan Stern, the principal investigator of New Horizons, declined to make predictions of what will be discovered. Based on Hubble Space Telescope observations, astronomers guess its diameter to be 20 to 30 miles. That would make its mass about a thousandth of Pluto's, Dr. Stern said, yet 10,000 times the mass of Comet 67P/Churyumov–Gerasimenko, which was studied by the European Space Agency's Rosetta mission. "We've never been to anything like MU69," Dr. Stern said. Scientists will have to wait awhile. **With the greater distance from Earth and slower transmission rates, it will take 21 months, until September 2020, for New Horizons to get the data from that encounter back to Earth.**