GRAVITY PROVIDES CENTRIPETAL FORCE FOR HUBBLE ORBIT

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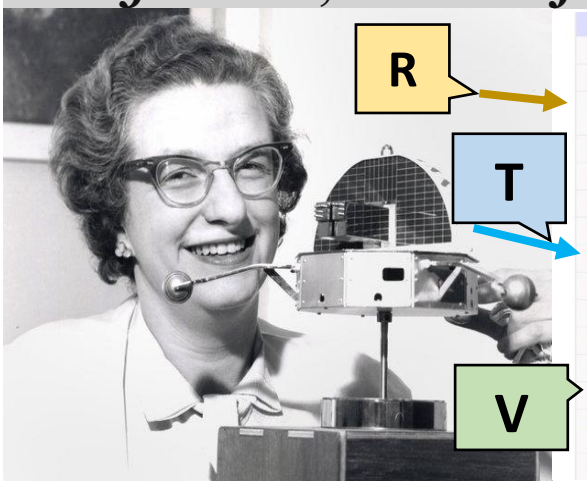
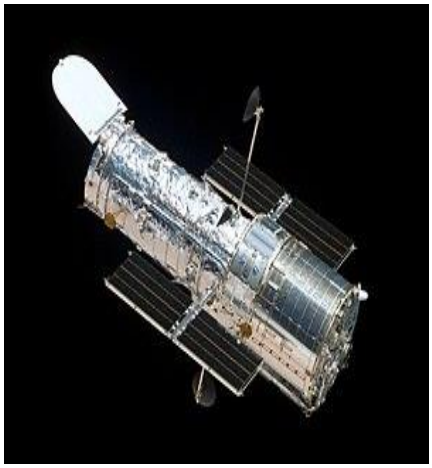
Nancy Roman, 'Mother of the Hubble' Telescope, Dies at 93



Orbital parameters	
Reference system	Geocentric
Regime	Low Earth
Semi-major axis	6,917.1 km (4,298.1 mi)
Eccentricity	0.000283
Perigee	537.0 km (333.7 mi)
Apogee	540.9 km (336.1 mi)
Inclination	28.47°
Period	95.42 minutes
RAAN	80.34°
Argument of perigee	64.90°
Mean anomaly	23.78°
Mean motion	15.09 rev/day
Velocity	7.59 km/s (4.72 mi/s)
Epoch	August 15, 2018, 21:40:27 UTC[4]
Revolution no.	35,441



Nancy Grace Roman with a model of an orbiting solar observatory in 1962. She was NASA's first director of astronomy and a leading advocate for the Hubble Space Telescope.

By Richard Goldstein Dec. 30, 2018 When Nancy Grace Roman was 11 years old, her family was living in Reno. She was enthralled by the stars in the clear night skies and joined with friends in forming an astronomy club. It was the beginning of a lifelong fascination with the cosmos. When she died on Wednesday in Germantown, Md., at 93**, Dr. Roman was remembered as "the mother of the Hubble." As NASA's first chief of astronomy and the first woman in a leadership position at the space agency,** Dr. Roman oversaw the early planning for the Hubble Space Telescope, **which began orbiting Earth above its atmosphere in April 1990 to capture an unobstructed view of the universe.** Placed into orbit from a manned Discovery shuttle and named for the pioneering American astronomer Edwin Hubble, it became the first large optical telescope in space. It has enhanced knowledge of distant galaxies as well as planets in our own solar system by transmitting images that would have been distorted if it were operating from within the Earth's atmosphere. The idea for that kind of large optical telescope had circulated in the scientific world since the astronomer Lyman Spitzer Jr. envisioned it in 1946. But the concept met with skepticism over feasibility and cost. So the road toward getting the Hubble into the skies was a long one. "It was Nancy in the old days before the internet and before Google and email and all that stuff who really helped to sell the Hubble Space Telescope, organize the astronomers, who eventually convinced Congress to fund it, " Edward J. Weiler, Dr. Roman's successor as chief scientist for the Hubble, told the Voice of America in 2011. In addition to coordinating the efforts of astronomers and engineers in their development of the Hubble, Dr. Roman wrote testimony for NASA representatives making the case for the Hubble before Congress and she pitched the project to the Bureau of the Budget. She was a trailblazer for women at a time when science was considered a man's world, and she became a longtime advocate for women in science. **"I still remember asking my high school guidance teacher for permission to take a second year of algebra instead of a fifth year of Latin," she recalled. "She looked down her nose at me and sneered, 'What lady would take mathematics instead of Latin?' That was the sort of reception that I got most of the way,"**

INTRODUCTION: With this application we will confirm mass of earth(M_{EARTH}= 5.9722 x 10^{24} kg. from NASA) & speed of Hubble Telescope(from NASA parameters above v = 7.59 km./s.) as it orbits earth. From NASA/Wikipedia are Hubble telescope's orbiting earth parameters(R = semi-major axis from center of earth , T= period of rotation to circle earth) in above center graphic table. Gravity supplies centripetal force causing Hubble to orbit earth. $GmM_e/R^2 = mv^2/R$ (eq.1) where $v = R\omega = R\,2\pi f = 2\pi R/T$, thus solving for $M_{EARTH} = (4\pi^2/G)(R^3/T^2)$. This is Kepler's third law. If we were to solve eq. 1 for v we would get $v = (GM_{EARTH}/R)^{1/2}$. eq.2

QUESTIONS: (a) Using Kepler's third law confirm mass of earth using R & T parameters of Hubble telescope?, (b) From Kepler was obtained eq. 2 for linear orbital speed. Confirm Hubble's orbital speed to be close to v = 7.59 km./s.?

HINTS: G = gravitational constant = 6.67 X 10^{-11} N $m^2/kg.^2$, π = 3.1416 , do all calculations in the mks system, 60 s./min.

ANSWERS: (a) M_{EARTH} - ~ 5.97532 x 10^{24} kg., close to NASA stated M_{EARTH} = 5.97219 x 10^{24} kg., (b) v =~ 7.556 km./s. (close)