CENTRIPETAL FORCE

Unit 14, Dr. John P. Cise, Professor of Physics, Austin Com. College Northridge Campus, Austin Texas USA, jpcise@austincc.edu & NYTimes June 14, 2019 by Dennis Overbye. Dedicated to Bill Nye

http://CisePhysics.homestead.com/files/ExoplanetHD17156bNOWsauron.pdf

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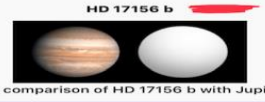
So Long, Exoplanet HD 17156b. Hello ... Sauron?

HD 17156	
Observation data	Epoch J2000 Equinox J2000
Constellation	Cassiopeia
Right ascension	02h 49m 44.4867s[1]
Declination	+71° 45′ 11.6322″[1]
Apparent magnitude (V)	8.17[2]
Characteristics	
Spectral type	G0IV[3]
Apparent magnitude (B)	8.76[2]
Apparent magnitude (V)	8.17[2]
Astrometry	
Radial velocity (R_v)	−3.15 ± 0.20[4] km/s
Proper motion (μ)	RA: 90.982 ± 0.064[1] mas/yr Dec.: −33.197 ± 0.062[1] mas/yr
Parallax (π)	12.7776 ± 0.0389[1] mas
Distance	255.3 ± 0.8 ly (78.3 ± 0.2 pc)
Absolute magnitude (M_V)	3.70
Details	
Mass	1.275 ± 0.018[5] $M_☉$
Radius	1.5007 ± 0.0076[5] $R_☉$
Temperature	6079 ± 80[6] K
Metallicity [Fe/H]	0.24 ± 0.05[6] dex
Age	$3.37^{+0.20}_{-0.47}$[6] Gyr



Size comparison of HD 17156 b with Jupiter.

Discovery	
Discovered by	Fischer *et al.*[1]
Discovery site	W. M. Keck Observatory Subaru Telescope
Discovery date	14 April 2007
Detection method	Radial velocity and Transit
Orbital characteristics	
Semi-major axis	0.1589 AU (23,770,000 km)[2]
Eccentricity	0.6768 ± 0.0034[3]
Orbital period	21.2163979 ± 0.0000159[3] d

The naming of celestial objects is usually an exclusive affair. But for its 100th anniversary, the International Astronomical Union is letting the world vote.

One benefit of discovery is that you get to name the things you discovered. Astronomy is blessed in this regard. **There are more stars in the observable universe than grains of sand on Earth, trillions upon trillions** — enough to name a galaxy for every human who ever did or will live and every god or goblin proposed by human imagination**. In the last two decades a new wonderland of naming opportunities has emerged with the discovery of planets around other stars, potential cradles of life and far-future adventure**. But so far exoplanets, like everything else in the sky, mostly don't have names, just numbers, like HD 156411 b or HAT-P-5b. Are they secret agents? Celestial nomenclature typically is a rigid and exclusive business, **closely managed by the International Astronomical Union**, the world organization of astronomers. But in celebration of its hundredth anniversary, the I.A.U. is sharing the fun, allowing every country in the world to name its own exoplanet and the star it calls home. On June 7, the organization released a list of stars and their planets for the 79 countries that have signed up so far for IAU100 NameExoWorlds, as the project is officially called. Each star on the list is visible and bright enough to be seen with a small telescope from the country that now has dibs on it. For the United States, that would be a yellow star named **(((HD 17156, a bit bigger(from NASA $M_{HD17156}$= 1.275 M_{sun}) and hotter than our sun, that lies about 255 light-years away in the constellation Cassiopeia. Its planet is about three times the mass of Jupiter and orbits the host star in 21 days, and so is surely an unlivable furnace))).*Some 4,000 possible exoplanets have been discovered in the Milky Way since 1995,*** by spacecraft like NASA's Kepler and TESS and by telescopes on the ground; by extrapolation, there could be billions of possibly habitable worlds in our galaxy alone. A few hundred have been confirmed as such by further observations. By astronomical tradition, whoever discovers a new planet or moon is entitled to suggest names for it to the I.A.U. The Union, which has 11,000 members in 93 countries, was founded in 1919 to promote international scientific cooperation. **Its new project follows on a campaign in 2015 that invited everyday Earthlings to vote on names for 14 stars and the 31 planets orbiting them.** Half a million votes came in from 182 countries and territories. All the exoplanets on the new list were discovered before 2012. (It took time and additional observations to confirm their existence.) They all were discovered by telescopes looking either for stars that wobbled as orbiting planets tugged on them, or that blinked as planets passed in front and briefly occluded them. ***Most are Jupiter-size, because monster exoplanets are the easiest, and thus the first, to be detected.***

INTRODUCTION: Exoplanets, as our solar system planets are held in orbit by gravitational centripetal force. $GmM/R^2 = mV^2/R$ This yields **Kepler's third law : $M_{mother\ star} = [4\pi^2/G](R^3/T^2)$, where R =** distance of exoplanet from mother star, T = period of exoplanet (in seconds) around mother star. From NASA/Wikipedia data tables **above R = 2.377 X 10^{10} m. & T = 21.216 days**. G = gravitational constant = 6.67 X 10^{-11} N $m^2/kg.^2$.

QUESTIONS: (a) Find T of this exoplanet HD 17156b(now Sauron)?, (b) Confirm mass of mother star is (as listed in table above as 1.275 $M_{OUR\ SUN}$ = 1.275 x 1.999 x 10^{30} kg. = ~ 2.549 X 10^{30} kg.) using Kepler's third law listed above.

HINTS: 24 hrs./day, 3600 s,/hr. ANSWERS: (a) T = 1.833 X 10^6 s., (b) $M_{Mother\ star\ HR\ 17156}$ = 2.37 X 10^{30} kg. CLOSE