A sense of planetary proportion

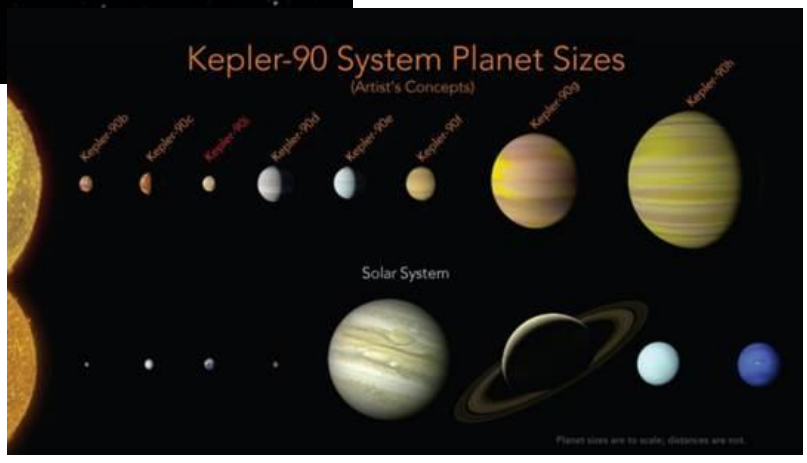
17 December, 2017

The serious media should concentrate on what they're good at, specifically keep a sharp eye on the government and ensure that each and every action of such government is disclosed, analyzed, and, if need be, criticized. However, the media love venturing in what is absolutely not their territory: science and technical issues. In so doing, they damage their credibility not only in the scientific and technical arenas, but more ominously and dangerously in the political arena.

In the Washington Post today (and in virtually all media outlets and Wikipedia).

Found: Another star system with eight planets, just like ours

complete with accompanying very detailed pictures, all made to look very real, but all doctored.



Let's contemplate some basic facts.

The star in question, Kepler 90, for which the article describes 8 planets in great detail, has been calculated to be at a distance from us of 2,545 light-years (two thousand five hundred and forty five).

Our galaxy is estimated to be between 100,000 and 180,000 light-years in diameter, with a thickness of 2,000 light-years, and to contain between 100 and 400 billion stars. Our Sun is just one of those stars.

Distance to stars is calculated from simple triangulation, taking advantage of the fact that as Earth travels around the Sun the perspective of the nearest stars appears to change slightly on the background of more distant stars. The distance to stars in the galaxy can be calculated with more or less accuracy up to a distance of 6,000 light-years from us. A consequence is that 99.6% of stars in our galaxy are beyond this theoretical limit.

Distances are measured using a satellite-borne astrometry apparatus and so far only the distances to about 120,000 stars have been measured with any form of accuracy, and to about 1,000,000 without much accuracy. That's respectively 0.000030% and 0.00025% of the stars in our galaxy, and 0.0000000000000003% and 0.0000000000000025% of all the stars we know of.

The space apparatus used to discover so called exoplanets is not really a telescope, it is rather a photometer, which measures the light coming from a star and notices slight recurrent variations, from which the presence of a planet thought to be passing in front of the star can be inferred. Not that the planet itself is ever seen: only its shade, so to speak, can be inferred from a tiny decrease in the luminosity of the star. Neither the shape of the star around which it travels can be seen.

The high definition space telescope, Hubble, has an angular resolution of 0.1 second of arc (there are 3,600 seconds of arc in one degree, as anyone knows). This means there cannot be any detail perceived for any object with an angular size of less than 0.1 second of arc. For example, a satellite surveying Earth's surface from an altitude of 600 kilometers, as is current, could visually separate details as close together as 30 centimeters. That's the best you can get, although not enough to recognize a human being.

Kepler 90 is said to be a star of about the same diameter as our Sun.

However, from a distance of 2,545 light-years, an angular resolution of 0.1 second of arc would mean that the smallest object that can be detected is 12 billion kilometers in diameter. Our Sun is 1.4 million kilometers in diameter, which is 10,000 times smaller. Earth is 12,800 kilometers in diameter, which is a million times smaller.

For a star the size of the Sun to be seen as a mere pixel on your screen, its distance from us would have to be less than 0.25 light-year. For a planet the size of Earth to be seen as a mere pixel, its distance from us would have to be 0.0025 light-year. See footnote.

Kepler 90 is 2,545 light-years away.

The whole NASA and media story seems to be severe exaggeration, extrapolation, and misrepresentation. From what is heard, the public believe in those fairy tales.

However, the Washington Post professes to despise those, like the author of this paper, they contend do not believe in science. Its owner is Jeff Bezos, the founder of Amazon, apparently a good shopkeeper but not as good a man of science as he seems to think, despite his ambition about space travel and tourism.

- One thing is missing in the official statements: a sense of proportion.
- One thing is pervasive in the official statements: a sense of self-promotion.

Note: the picture of Earth in the NASA's photos covers 350 pixels, 21 pixels across. To see the planet with such accuracy the telescope would have to be at a distance of only 0.0001 light-year, or about 1 billion kilometers. Kepler 90 is at a distance of 25 million billion kilometers. It would take 625 trillion Earths to fill just one pixel