Researchers conclude the universe contains fewer Earth-like planets than previously thought

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This is the "South Pillar" region of the star-forming region called the Carina Nebula. Like cracking open a watermelon and finding its seeds, the infrared telescope "busted open" this murky cloud to reveal star embryos tucked inside finger-like pillars of thick dust. Credit: NASA

(Phys.org)—A small team of researchers, three with Swedish Institutions and one from the U.S. has created a computer model of the known universe and in using it to estimate the number of likely other exoplanets

able to hold life, has found that there might be fewer Earth-like planets than has been thought. In their paper they have uploaded to the preprint server, *arXiv* (soon to be published in *The Astrophysical Journal*), the team describes how they went about creating their model and what it showed.

The team took a logical approach in creating their model, first inputting data that described as much as is known about the early universe—then next adding data about known exoplanets and also information describing the laws of physics and the way they would work on the elements that made up the universe, and how they would grow or change over approximately 13.8 billion years. They then took a virtual census and found the model had "created" approximately 700 million trillion exoplanets—but, to the surprise of the researchers, the vast majority of them were far older than planet Earth.

If correct, the models suggest that Earth is much more unique than other models have been showing in the past few years. This is because it is assumed that if life began on other planets far earlier than on Earth, because it would be much older, it should have matured beyond what we have here on Earth to the point that it would be not only noticeable to us, but likely dominant. But because we have not seen any sign of other life, it appears likely that none is there, or is close enough to spot, which suggests that Earth actually is much more unique than other recent models have been suggesting. The model also suggested that most exoplanets likely exist in galaxies that are a lot bigger than the Milky Way, and orbit stars that are quite different from our sun. To date, space scientists have identified approximately 2,000 exoplanets, clearly a very small proportion of the total amount if the new model is to be viewed as accurate.

The researchers acknowledge that their model is based on data that is still only partly understood, and that much of what we have observed to

date is still somewhat hazy, thus, it is not clear just how accurate their model really is.

More information: Terrestrial planets across space and time, arXiv:1602.00690 [astro-ph.GA] arxiv.org/abs/1602.00690v1

Abstract
The study of cosmology, galaxy formation and exoplanetary systems has now advanced to a stage where a cosmic inventory of terrestrial planets may be attempted. By coupling semi-analytic models of galaxy formation to a recipe that relates the occurrence of planets to the mass and metallicity of their host stars, we trace the population of terrestrial planets around both solar-mass (FGK type) and lower-mass (M dwarf) stars throughout all of cosmic history. We find that the mean age of terrestrial planets in the local Universe is 8±1 Gyr and that the typical planet of this type is located in a spheroid-dominated galaxy with total stellar mass about twice that of the Milky Way. We estimate that hot Jupiters have depleted the population of terrestrial planets around FGK stars at redshift z=0 by no more than ≈10%, and predict that ≈1/3 of the terrestrial planets in the local Universe are orbiting stars in a metallicity range for which such planets have yet to be been detected. When looking at the inventory of planets throughout the whole observable Universe (i.e. in all galaxies on our past light cone) we argue for a total of $\approx 2\times 10^{19}$ and $\approx 7\times 10^{20}$ terrestrial planets around FGK and M stars, respectively. Due to the hierarchical formation of galaxies and lookback-time effects, the average terrestrial planet on our past light cone has an age of just 1.7±0.2 Gyr and is sitting in a galaxy with a stellar mass a factor of ≈2 lower than that of the Milky Way. These results are discussed in the context of cosmic habitability, the Copernican principle and the prospects of searches for extraterrestrial intelligence at cosmological distances.

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