The Meaning of the Singularity: 2. Astro-Sociology: Predicting the Presence of Twin Planets (short version)

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Abstract

We present a remarkable analogy between the human society and Astronomy. Please keep an open mind as **the resemblance is both qualitative and quantitative.** We link stars and children with persons and planets. The two genders are matched with cool and hot stars and with gas and solid planets. **The mean values of the distributions of star multiples and US households are almost identical**. **Moreover, an amazing resemblance between the two curves is evident.** In addition, the distribution of gas / solid planets is similar to that of boys / girls as well, and the fit could improve once selection effects are considered. **Monte Carlo simulations suggest that our results are significant at a confidence level of 99.9%!** We thus predict that about a third of stars harbor planets and that stars are equally divided between hot and cool stars and planets between gas and solid planets. The presence of 4 gas and 4 solid planets in the solar system supports our prediction. We forecast that the mean number of planets around host stars should be near two, and vision the presence of **twin planets** that share the same orbit. The wealth of known extra-solar planets should already contain a few such systems.

1. Introduction

Astronomy is the observational study of stars while Astrophysics is the theoretical research in this field. Sociology is the scientific or systematic study of human societies. Apparently, there should not be any relation between the two fields. However, in a new series of papers, we present new ideas in Physics and Cosmology, and novel concepts for particles as well as an intriguing solution to the two major riddles of Cosmology – dark matter and dark energy [1-3]. In the first paper, it was demonstrated that physics cannot really exist in a single particle universe, and thus at least two particles are required to form the known world. It was, therefore, concluded that there is no detachment at all [1]. It follows that the universe is not really separated from the observing scientist, and links between astronomical objects and people can surprisingly exist. In this paper, which is the shorter version of our extended work [2] and a natural extension of our first paper [1], we point out some similarities between stars and the human race and set the foundations of a novel multi-disciplinary research area, which we name Astro-sociology.

2. The analogy between stars and humans

The basic brick in Astronomy / Astrophysics is a star, which we link with a human being. Each person represents an expression of the singularity, thus it is unique - different than the others and no two are the same, not even identical twins. Similarly, any star should be different than the other. This is consistent with current observations. In example, the search for a 'solar twin', a star with the same astrophysical parameters as the Sun, is still ongoing [4].

Main sequence stars are broadly divided into two major groups. The historical separation into the classes of cool and hot stars is based on their internal structure. Types O-A are the hot stars and types F-Y are the cool stars. Hot stars burn hydrogen through the CNO cycle, while cool stars through the proton-proton chain [5-6]. We link the two kinds of stars with the two human genders. Since O-A stars are warmer we match them with women and the F-Y stars with men.

According to our ideas, the bond between stars and people should be expressed by numbers, distributions etc. For the comparison between mankind and stars we used the updated statistics of the American population, which is easily available on the US Census Bureau website [7]. The USA inhabitants may not fully represent the global world population, but we believe that the differences between the two are small and thus would not alter the results presented in the paper.

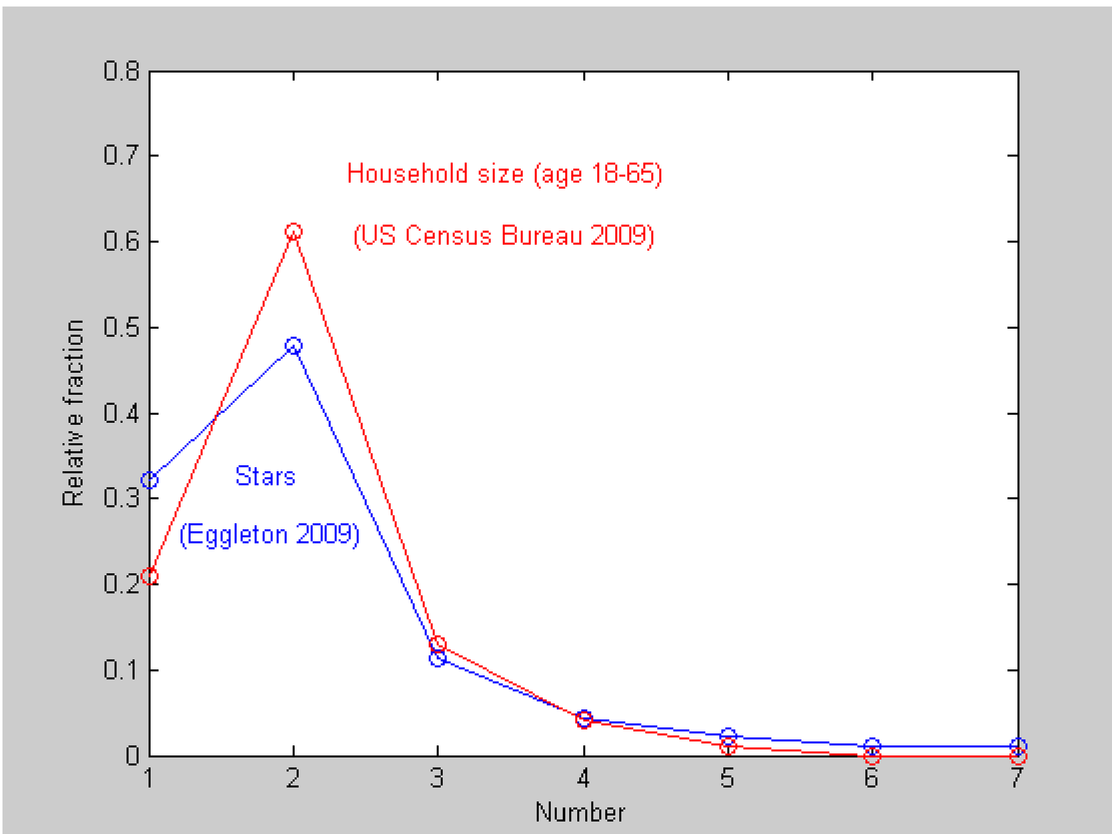

Fig.1 – A comparison between the star multiples distribution with that of American households in 2009. There is a remarkable similarity between the two curves. The mean value in humans is 2.03, while that of stars was estimated as 2.04 based on observations and a thorough analysis of selection effects. From numerical simulations we deduced that there is less than 3% chance probability to randomly achieve this result.

The multiplicities of stars were recently collected for a set of several thousand bright stars with Hipparcos [8]. The observed sample contained multiplicities up to 7. Taking into account the observational biases, it was concluded that the actual distribution of stars in 1, 2…7 multiples is respectively 1459, 2179, 517, 202, 101, 44, and 48, which are 32.1, 47.9, 11.4, 4.4, 2.2, 1 and 1% [9]. We compared these numbers with the figures of the USA adult population in 2009 [7]. The numbers of 1, 2…5+ members in the age interval of 18-65 years old in 1000 units were 14900, 43479, 9190, 2878 and 739 for all households. These data correspond to 20.9, 61.1, 12.9, 4.1 and 1% of 1, 2…5+ adults in household, and yield a mean of about 2.03 adults in household, which is remarkably consistent with the average stellar multiplicity – 2.04 [9]. In Fig. 1 we plot the two distributions. The resemblance between the two distributions is outstanding. Indeed, we estimated from extensive Monte Carlo simulations that the two distributions are consistent with each other with a probability level higher than 97% [2].

3. Planets and children

We continue the analogy between humans and stars by linking children with planets. The search for extra-solar planets has been very fruitful in the past decade, and as of March 3rd 2010, 429 planets have been discovered by various observational techniques [10]. Planets are regularly divided into two types – gas Jupiter-like planets and solid Earth-like planets. According to the mass estimates, the vast majority of the identified planets are gaseous, which are much more massive than solid planets, and are thus easier to detect. Note that Jupiter's mass is about 300 larger than Earth [11]. We respectively associate gas and solid planets with boys and girls (under 18 years old). Thus, since very few Earth-like planets occupy the list of known extra-solar planets, the correct comparison of most planets should be made with boys instead of children.

The bordering mass between gas and solid planets is unknown. A reasonable assumption for this limit is 20 $M_\oplus$- twenty times the Earth's mass [12-13]. Adopting this value implies that 38 known extra solar planets are solid, so they only comprise less than 10% of the planet list. Among the 391 selected massive exo-solar planets 304, 62, 21 and 4, which are 77.7, 15.9, 5.4 and 1%, have 0, 1…3 'sibling' planets, i.e., with the same host star. The distribution of boys only is not available on the US Census Bureau website, and thus it is estimated from the data of their siblings. Among the 37,959,000 American boys, 8106, 14683, 9375, 3826, 1159 and 810 thousand boys had 0, 1…5+ brothers or sisters [7]. The frequency of the two genders is very similar - boys comprise ~51.1% of all children. The binomial distribution thus implies that about 18053, 13990, 4600, 1073, 215 and 28 thousands boys had 0, 1…5+ brothers. Thus, about 47.6, 36.9, 12.1, 2.8 and 0.6% of American boys had 0…4+ brothers. The distributions of planets and boys are plotted in Fig. 2. They display the same descending trend and we believe that a better match will be produced once taking into account the selection effects as was done for star multiples (Section 2), because it is clear that current surveys only find part of all gas planets in a host star system.

The distribution of girls and solid planets can also be compared. Among a total 36,269,000 American girls, 7645, 14111, 8895, 3695, 1134 and 789 thousand girls had 0, 1…5+ brothers or sisters [7]. Using the binomial distribution it is concluded that about 17787, 13185, 4154, 942, 179 and 22 thousands girls had 0, 1…5+ sisters. Therefore, about 49.0, 36.4, 11.5, 2.6 and 0.5% of American girls had 0…4+ sisters. Unsurprisingly, this distribution is almost identical to boys'. Adopting the maximum upper limit of 20 $M_\oplus$ for solid planets, it is found that 52.6, 13.2, 23.7 and 10.5% have 0, 1, 2, 3 sibling light planets. This distribution was added on Fig. 2, and the similarity to the distribution of girls, which is nearly equal to boys', is clear.

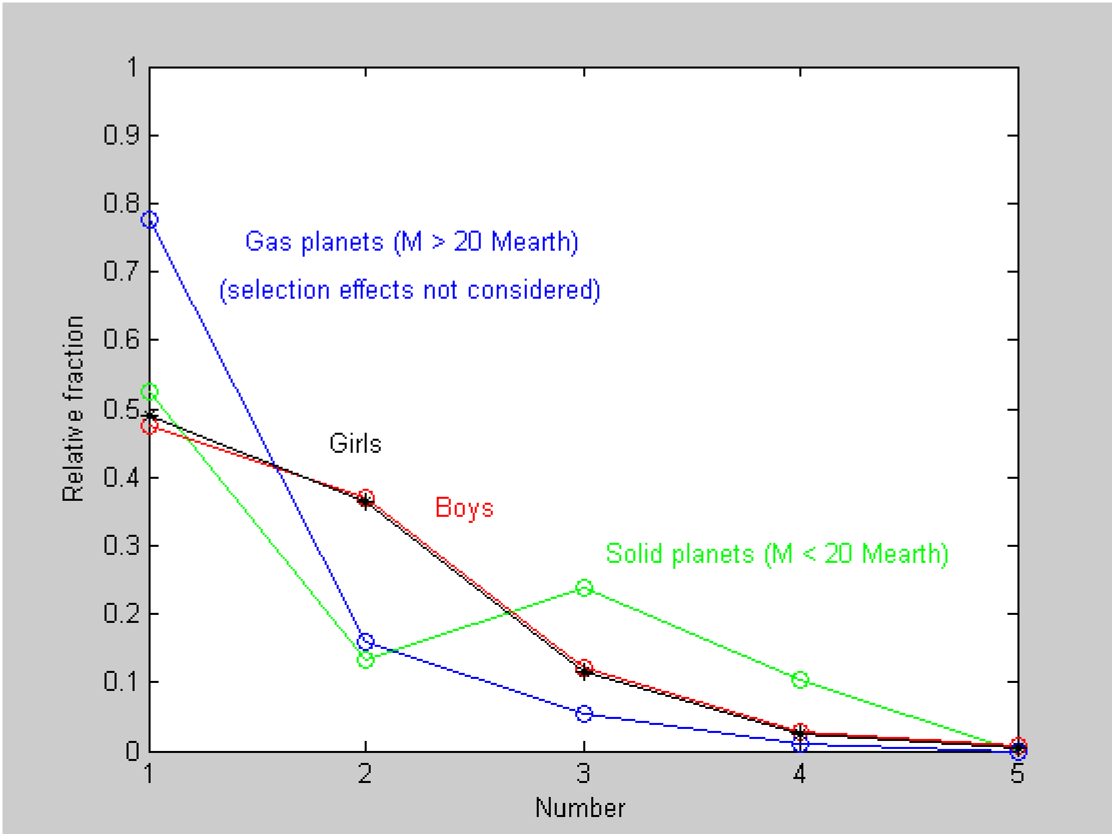

Fig. 2 – A comparison between the distributions of boys, which is almost identical to girls, in USA families in 2009 with number of gas / solid planets around host stars. We respectively link boys and girls with massive gas and light rocky planets. The mass limit between these two populations was taken as 20 $M_{\oplus}$, implying that more than 90% of recorded planets are gaseous. There is an apparent resemblance between the distributions. The current qualitative difference could be explained by not considering the impact of the observational selection effects that are involved in the planets search.

4. Predictions

American females and males respectively comprised ~50.5% and ~49.5% of the total population [7]. We therefore predict the all stars will be nearly equally divided between O-A and F-Y stars. The number of families with own children below 18 years old were about 35.6 millions compared to a total of 117 million households [7]. Thus, we predict that planets should be found around about a third of all stars. The rates of American boys and girls among the total children population are also almost similar: ~51.1% vs. ~48.9% [7]. Therefore, we anticipate that the average number of the equivalent Jovian and Earth-like planets around parent stars should be nearly equal. The average number of children under 18 years old in American households with children in 2009 was about 1.9 [7]. We therefore forecast that the mean number of both gas and rock planets in parent star systems behaves like the values in humans, i.e., close to two. It is also predicted that the average number of Jupiter-like planets around parent stars with gas planets should be ~1.4 – similar to the number of boys in an American family with boys [7]. Thus, we estimate that about 25% of Jovian planets are missed by current observations, whose mean is 391/343=1.14. A similar value of ~1.4 solid planets is expected in host star systems with Earth-like planets.

The mean number of planets around stellar systems can be estimated by considering only the planets with the lowest masses and their 'siblings'. If light Earth-like planets are detected in these systems then presumably all other massive planets are likely to be observed as well. The 38 known lightest planets are found in 27 stellar systems and have 17 massive 'sibling' planets [10]. This yields an average of 55/27=2.04 planets per parent star, which is consistent with the mean value of 1.9 found in American children [7]. Note that the average number of solid planets in these systems is 1.41, which is compatible with 1.39 - the mean number of girls in American families with girls.

Due to the mass difference, it is obvious that the relative frequency of gas extra-solar planets detected so far is artificially increased compared with currently known rocky planets. Our prediction for a similar frequency of gas and solid planets can be easily evaluated, however, by a single example - the nearby solar system, where all planets are observed. Notably, the Sun harbors four gaseous planets and four solid components [14]. This equality supports our suggestion.

In 2006 more than 3% of births among the US population were twins [15]. We propose that twin planets should be found around stars as well. We interpret this as the existence of more than one planet at the **same orbit**. We thus expect that more than 3% of planet systems have twins. Naively, this implies that among the 429 known extra-solar planets, about a dozen may have twins. However, the detection of such systems in radial velocity searches may be difficult because the effect they impose on the parent star may be reduced and even canceled for identical twins, which presumably have the same mass. Thus, the actual number of twins among the known planets may be somewhat lower. Imaging offers a high potential to detect twin planets either identical or unidentical, which we suggest have different masses. Identical twin planets may appear similar in transits making the observed period shorter by a factor of two than the correct orbital period. Non-identical twins would have different transit profiles and depths, probably like the light curves of hot Jupiters, which are very close to their parent star and have very short orbital periods [16]. Thus, unidentical twin planets should be easier to detect by this method. Among the 69 known transiting planets two systems may have twins. In fact, we suggest that KOI-74b and KOI-81b, two recently discovered unusual transiting objects [17], could be unidentical twins. It is interesting to note that theoretical studies allow the possibility of twin planets – in co-orbital motion [18], and it was actually proposed that the pairs of planets in two systems (HD 128311 and HD 82943) may be Trojan (twin) planets [19].

4. Discussion

We are the first to admit that the results presented in this paper are quite shocking and difficult to believe and to understand for any astrophysicist, scientist or layman. A remarkable similarity was found between the astronomical objects observed in the night skies and humans. This striking similitude could be attributed to the fruitful imagination of the author and regarded anecdotal and childish, but it is also numeric. The distributions of star multiples in a few thousand bright nearby stars and number of adults in American households are compatible, and the averages of the two are almost identical (Section 2). Fig. 2 shows that the distributions of boys and gas planets as well as the distributions of girls and solid planets have a similar decreasing trend, and we believe that by taking into account the selection effects involved in the detection of extra-solar planets and with more data, the resemblance significantly improves. From numerical simulations we concluded that the combination of these results is significant at a confidence level of about 99.9% [2].

It is pointed out that we do not think that the matching between astronomical objects and people is absolute. One should not expect to find a specific star for himself. In fact, we can point out numerous differences between stars and people. In example, the number of stars in the observed sky, which was estimated as 10^{22} [20] is much higher than the world population, which accounts to about seven billion [21]. Another example is that stars are nearly spherically symmetric while (most) people obviously don't. Yet, the extensive resemblance between the Astronomy world and humans is disturbing and requires an explanation. One may argue that Nature acted the same way when the universe, the stars and people were created. This is a nice solution however we think that our results bear a more profound meaning. We believe that the ideas presented in this work strongly suggest that the human perception is linked with the universe and undetached from it. The whole manifested universe and in particular the human society are understood as reflections and expressions of the unmanifested consciousness (the singularity).

We believe that the observations of the current universe should reflect the present status of human society and changes in time seen in humanity will have equivalents in the observed sky. The accelerating pace of modern life is such an example, which can be related with the universal acceleration [22-23]. This unexpected finding was connected with dark energy, which with dark matter, are currently the major problems in Astrophysics and probably in Physics as well. In the next papers of the series we offer a simple explanation of these riddles and further argue that the universe is not real, but it is a reflection of the human mind, something like a hologram, an allegory for the human consciousness!

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