The enigma of the missing stars in space may be solved

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In the local group of galaxies, there are about 100 billion stars. According to astronomers' calculations, there should be many more. Now, physicists from the University of Bonn and the University of St. Andrews in Scotland may have found an explanation for this discrepancy. Their study will appear in the upcoming issue of the *Monthly Notices of the Royal Astronomical Society*.

New stars are born in the Universe around the clock – on the Milky Way, currently about ten per year. From the birth rate in the past, we can generally calculate how populated space should actually be. But the problem is that the results of such calculations do not match our actual observations. "There should actually be a lot more stars that we can see," says Dr. Jan Pflamm-Altenburg, astrophysicist at the Argelander-Institut für Astronomie of the University of Bonn.

So, where are those stars?

For years, astronomers worldwide have been looking for a plausible explanation for this discrepancy. In cooperation with Dr. Carsten Weidner from St. Andrews University, Dr. Pflamm-Altenburg and Professor Dr. Pavel Kroupa, Professor of Astrophysics at the University of Bonn, may now have found the solution. It seems that so far, the birth rate has simply been overestimated. But this answer is not quite as simple as it sounds. Apparently, the error of estimation only occurs during periods of particularly high star production.

The reason for this lies in the manner in which astronomers calculate the birth rate. "For the local Universe – i.e., the Milky Way as our home and the adjacent galaxies – it is relatively simple," explains Professor Kroupa. "Here we are able to count the young stars one by one, using huge telescopes."

The problem with this method is that it only works for our immediate vicinity. But many galaxies are so distant that even the best telescope simply overlooks their small stars. As luck would have it, however, occasionally there is an especially large whopper among the newbie's in the sky. Such a star will, even if it cannot be directly discovered as an individual star, leave its traces in the light of even the farthest galaxies. The number of large whoppers then determines the strength of this trace.

In our immediate vicinity, these large whoppers occur with a fixed probability. There are always about 300 lightweights to one "big star baby." This numerical ratio seemed to be universal. So it was sufficient for astronomers to know the number of the large whoppers, for this allowed them to determine the number of new-born stars by simply multiplying the former number by a factor of 300.

Population explosion in space

Recently, however, some Bonn astronomers around Professor Kroupa began doubting the fixed ratio. Their hypothesis is that at times when the galactic nurseries are booming, they generate a considerably higher number of stellar heavies than normal. The reason for this, according to this theory, is so-called stellar crowding. For stars are not single children; they are born in groups, as so-called star clusters. At birth, these clusters are always of a similar size – no matter whether they contain 100 star embryos - or 100,000.

Consequently, at times of a high birth rate, space can be at a premium in

star clusters. Astronomers call such galaxies that are particularly rich in mass "ultra-compact dwarf galaxies," or UCD's for short. In these, things are so tight that some of the young stars fuse during formation. Thus, more stars rich in mass than normal emerge. The "small to large" ratio is then only about 50 to 1. "In other words, we used to estimate the number of newly formed small stars by far too high," explains Dr. Carsten Weidner.

The researchers from Bonn and St. Andrews have now corrected the birth rates according to the projections of the stellar crowding theory. With an encouraging result – they actually arrived at the number of stars that can be seen today.

More information: Paper online: arxiv.org/abs/1011.3814

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