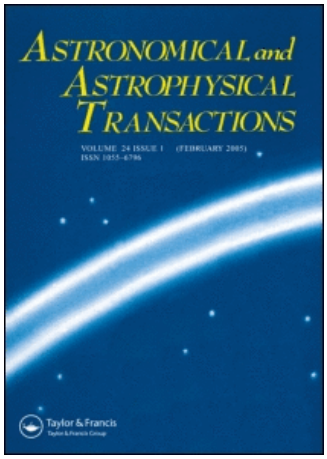

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713453505

A new anthropic principle

R. I. Khrapko [a]
[a] Moscow Aviation Institute, Moscow, Russia

Online Publication Date: 01 December 2003
To cite this Article: Khrapko, R. I. (2003) 'A new anthropic principle', Astronomical & Astrophysical Transactions, 22:6, 847 - 850
To link to this article: DOI: 10.1080/10556790310001644864
URL: http://dx.doi.org/10.1080/10556790310001644864

Astronomical and Astrophysical Transactions
Vol. 22, No. 6, December 2003, pp. 847–850

A NEW ANTHROPIC PRINCIPLE

R. I. KHRAPKO*

Moscow Aviation Institute, 125993 Moscow, Russia

(Received 10 November 2002)

An answer to Fermi's question, 'Where are they?', is presented. The answer is: we are alone because our Universe is bad for civilization. The combination of physical constants does not need to be more fine tuned than is necessary to permit one civilization and, since extreme fine tuning of the constants is a very unlikely event, it is most likely that our Universe is just good enough to permit the development of *only one* civilization. The alternative anthropic principle can be formulated as follows: 'It is most likely to observe a universe in which civilized life is an extremely rare phenomenon.'

Keywords: Multiverse; Fundamental constants; Drake's equation

The fact is that mankind is alone in the Universe and therefore lonely. We listen to the Universe, but we hear nobody. We call out loudly in the Universe, but nobody answers. People have invented unidentified flying objects and panspermia because of the melancholy due to the loneliness. People have believed in God because of this melancholy. The scientist Blaise Pascal, who believed in God, wrote 'Eternal silence of these boundless spaces horrifies me. Silence is the greatest of all persecutions. Saints never were silent.' However, scientists should not grieve. They should try to discover why we are alone.

An answer to the question of why we are alone, naturally, is related to the question of why we exist. As is known, we exist owing to physical laws and because the values of physical constants are favourable for life. However, according to the anthropic principle, our Universe is fine tuned. A small change in the physical constants may make the Universe unsuitable for life. In other words, the range of values of the constants that permit life is extremely small. The range of values admitting civilization is even less. We shall call this the anthropic range. Why have constants got an anthropic range?

The reasons for the realization of such improbable values of the constants in our Universe were discussed at the conference entitled *Anthropic Arguments in Fundamental Physics and Cosmology*, which was held in Cambridge from 30 August to 1 September 2001 (see the report by Carr (2001)). The basic idea was the proposal of a multiple universe or 'multiverse'. This means that an enormous or infinite number of universes with various physical laws and various physical constants can exist, but one can observe only a universe that permits the existence of an observer, a universe whose constants are in the anthropic range, that is an anthropic universe, no matter what the size of the range. So, the small probability of an

* E-mail: khrapko_ri@mai.ru or khrapko_ri@hotmail.com

ISSN 1055-6796 print; ISSN 1476-3540 online
DOI: 10.1080/10556790310001644864

anthropic universe is of no importance for the observer. Similarly, the probability of my occurrence in the universe is negligible. However, I observe myself.

Other questions are also very interesting. How common are civilizations in an anthropic universe and in our universe? Why are we still alone?

The reasons for our loneliness were not discussed at the conference, but Crawford and LePage (2000) considered the following question in detail: 'Where are they?' To estimate the number of civilizations in our galaxy, one may multiply eight factors in the Drake equation (Goldsmith and Owen, 1980).

number of communicating civilizations in our Galaxy
= number of stars in the Galaxy (factor 1)
× fraction of stars that last long enough for life (factor 2)
× average number of planets per star (factor 3)
× fraction of planets suitable for life (factor 4)
× fraction of those planets where life actually develops (factor 5)
× fraction of planets with life where intelligent civilizations arise (factor 6)
× lifetime of civilization with the ability and desire to communicate (factor 7)
$\times \dfrac{1}{\text{lifetime of the Galaxy}}$ (factor 8).

Goldsmith and Owen denoted factor 7 by L and obtained the following result:

$$\text{number of communicating civilizations in our Galaxy} = 400 \text{ billion stars} \times 0.5 \times 10 \times 0.025 \times 0.5 \times 0.5 \times \frac{L}{10 \text{ billion years}} = 1.25L,$$

where L is the lifetime measured in years.

It seems to me that we should neglect the probability of a lifeless planet suitable for life and should combine factors 4 and 5. This small probability of the existence of such planets is rejected by the directed panspermia idea which was considered by Crick (1962) in detail. I would like to divide factor 6 into two factors. I see a considerable difference between religious civilizations (Buddhism, Christianity and Islam) and an atheistic civilization. The idea of the existence of a Creator of the Universe and mankind excludes the idea of a search for other civilizations. Only an atheistic civilization is capable of becoming interested in extraterrestrial civilizations. Therefore, the occurrence of an intellect that is so perfect that it is capable of rejecting the idea of God is worthy of a separate factor. Really, it needs the Stendhal intellect to understand that God might be excused only by his absence.

It seems to me that the Drake equation should be written as follows:

number of communicating civilizations in our Galaxy
= number of stars in the Galaxy (factor 1)
× fraction of stars that last long enough for life (factor 2)

$\times$ average number of planets per star (factor 3)

$\times$ fraction of planets suitable for life (factor 4)

$\times$ fraction of planets with life where civilizations arise (factor 5)

$\times$ fraction of planets with civilizations where atheistic civilizations arise (factor 6)

$\times$ lifetime of civilization with the ability and desire to communicate (factor 7)

$$\times \frac{1}{\text{lifetime of the Galaxy}} \text{(factor 8)}.$$

Meanwhile it is obvious that the values of physical constants are related directly to the Drake factors. So, among anthropic universes there are universes that are more or less favourable for civilizations and, if the probability of an anthropic universe is very small against the background of all universes, it is natural to expect that the probability of a universe especially favourable for civilizations will be very small against the background of universes that admit only one civilization and, in particular, that are rather adverse marginal universes adjoining non-anthropic universes.

In such adverse universes, which occur at the edge of anthropicness, a civilization should arise extremely seldomly and only in a case of confluence of many favourable circumstances, but such universes are the most probable among anthropic universes. Therefore, one should not be surprised that the Universe in which we have the pleasure to be is ungenerous with the number of civilizations.

It is possible to exemplify this argument. The outstanding astrophysicist I.S. Shklovsky explained our loneliness. He wrote: 'Practically all stars such as our Sun are parts of double (or multiple) systems. Life may not develop in such systems, as the temperature of surfaces of their hypothetical planets should vary in inadmissible wide limits. It looks as if our Sun, a strange single star surrounded with a family of planets, is an exception in the world of stars.'

Our idea is the following (Khrapko, 2001). Let us first admit that change in the constants that will increase the percentage of single stars in the Universe is possible. The change will increase the Drake factor 4 and will make civilizations more widespread, but such a universe would be less probable than ours. Its physical constants should have values in a very small privileged part of the anthropic range.

I think the part of the anthropic range that provides humanoid understanding about the necessity to restrict the birth rate in advance is extremely small. The constants in our Universe are not in that part! So, the Drake factor L is small.

Therefore, in conclusion I should like to state that, probably, there are no bases to consider that the present physical constants have successful values. Because of our loneliness in the Universe, the constants are in fact not so successful, and this should be expected. It is necessary to expect that we appeared in one of the most probable anthropic universes, in one which is the worst adapted to the origin of civilizations by virtue of its greatest probability. We exist and that is pleasant; however, we exist, probably in loneliness, on the edge of civilized life in a metauniverse sense. An alternative anthropic principle can be formulated as follows. It is most probable to observe a universe in which civilizations are an extremely rare phenomenon. We have just that very case.

The anthropic principle forbids other types of civilization in our Universe, for example the Hole's Black Clouds, a no-carbon civilization or a civilization on the surface of neutron stars. For the genesis of other civilization, the constants must be in another small civilization range, and it is unbelievable that the extremely small anthropic range intersects with other civilization ranges.

References

Carr, B. (2001) *Phys. World* **23**.
Crawford, I. and LePage, A.J. (2000) *Sci. Am.*
Crick, F. (1962) *Life Itself.* Simon and Schuster, New York.
Goldsmith, D. and Owen, T. (1980) *The Search for Life in the Universe.* Benjamin, London.
Khrapko, R. (2001) physics/0105031, Section 9.