

The Anthropic Cosmological Principle In Its Three Interrelated Forms (Weak, Strong, and Superstrong ACP) And The Universal Cosmological Principle (UCP) As A Basis For Theoretical And Practical Cosmology

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Abstract: Anthropic cosmological principle was established by the author in 1958. This principle only derives its universality from the systems discovered by the author – logical, theoretically well determined, interrelated, and periodical – cyclically closed. These are the systems of the prototypal fundamental structural elements of the matter at each of the four possible successive basic levels of its natural self-organization – physical, chemical, biological, and, finally, psychological (i.e. conscious or mental – the most **fundamental, underpinning all** others).

My monograph, *The Cosmic Matter*, was first published in the USSR in 1957 as part of the academic popular science series [1]. In 1958 it was translated into Spanish and published in Buenos Aires, Argentine, and in 1959 its translation into Chinese was published in Beijing, the People's Republic of China. In this monograph I specifically emphasized that our Earth was only a common although typical, in a way, planet in the Solar system; our Sun was only a common although typical, in a way, star within our Galaxy; our Galaxy was only a common although typical, in a way, galaxy within our Metagalaxy; all our directly accessible Metagalaxy was only a common although typical, seemingly distinct part of the Universe; while the unique, all-encompassing Universe with its principally inexhaustible – fractal – structural hierarchy of its omnifarious subsystems, invariably retaining all its attributes, was spatially infinite as well infinite in time and with an infinite total mass, while having, in the limit – with the endless structural hierarchy of its subsystems and their relativistic mass defects taken into account – a zero mean density.

It was also at that time that, in a paper presented at the VIth All-Union Conference on the Issues of Cosmogony [2] and a relevant scientific article [3], I had for the first time introduced into modern cosmology and analyzed in detail the so-called anthropic cosmological principle.

Later albeit absolutely independently from me, in an attempt to explain the mysterious numerical coincidences of the certain large relative numbers in the macro- and microcosms, Brandon Carter arrived at similar ideas [4]. He had introduced the term, **the Anthropic Cosmological Principle (ACP)**, and regarded the *weak* or *strong* forms of ACP (WAP or SAP) as a condition where emergence and existence of Life and Mind in the Universe became *possible* or *necessary*.

This seemingly *metaphysical* principle and the fact that it had been first introduced in my 1958 paper were eventually noted by our physicists and cosmologists such as the Academicians Ya.B.Zeldovich [5] and A.D.Sakharov [6] while John D. Barrow and Frank J. Tipler, in the introduction to their monograph devoted to ACP with a foreword by John A. Wheeler, had specifically mentioned my 1958 paper [3] as a pioneering work dedicated to the Anthropic Cosmological Principle.

Actually, Protagoras had anticipated this principle back in the 5th century BC, having opened his work devoted to Nature with a prophetic aphorism that has reached into our times.

“Man is the measure for all things, of the existence of the things that are and the non-existence of the things that are not” [8].

On the other hand, I, having first considered the basic principles of the mathematic theory of communications between the intellectual individuals [9, 10] and then the basic mathematical principles underpinning all natural science [11-13], proceeded from the *strong* or *weak* ACP to *superstrong* ACP (implying the existence of the Supreme Intellect as an indispensable special – the ultimate and, at the same time, the initial - mental element) [14-16].

Matter, Life and Intellect (perceived as co-cognition or, perhaps, co-thinking) are most closely interconnected [17 – 22]. The ‘Anthropic Program’ initiated by me and described by K.A.Tomilin in a special section of his monograph was also related to the anthropic principle [23, p. 293-308].

Moreover, back in 1961, basing on causality as an indispensable foundation of cosmology, I had formulated the **Universal Cosmological Principle (UCP)**. According to this principle, all quantitative characteristics X, when transferred from an arbitrary part of the Universe to the whole unique Universe, either lose their meaning altogether (because of the lack of the respective limit) or remain identically constant (being nothing else than appropriate universal – fundamental – dimensional or non-dimensional world constants), or assume one of the two natural extreme values – infinite or zero, which principally differ from the voluntary (random) particular values [24, 25].

Thus, as I have noted back in 1956 [26], the Universe as a whole is, a fortiori, necessarily eternal in time and spatially infinite, with an infinite total mass and a zero mean (extremum) density, and is the only real fractal.

A fortiori, an adequate relativistic model of the whole Universe, in contrast to its any volatile part (e.g. our Metagalaxy that is directly observed by us), is necessarily uniform, isotropic and static, with the fundamentally zero mean – extremum – density, and lacks any non-zero cosmological constant [27].

In contrast to accordingly revised Einstein’s unique basic cosmological model which is static, uniform and isotropic (with zero mean density), various non-stationary (expanding, contracting or pulsing), uniform and isotropic so-called Friedman’s cosmological models only apply, in spite of the numerous affirmations, to certain parts of the Universe such as, for instance, our Metagalaxy directly observed by us, rather than to the Universe as a whole.

Man begins to cognize the whole inhabited world (the Universe) from within, occupying the middle step in the hierarchical cosmic structure, i.e. he is neither the minimum nor the maximum object of this world, being something in-between.

The size and the mass of human brain (~ 10 cm, $\sim 10^3$ g) approximate the geometric means of the respective characteristics of our ‘space macro-cradle’, i.e. of the Solar system, ($\sim 10^2$ AMU $\approx 1.5 \cdot 10^{15}$ cm, $\sim 2 \cdot 10^{33}$ g) and of a typical elementary representative of the microcosm, the electron ($1.4 \cdot 10^{-13}$ cm, $9 \cdot 10^{-28}$ g):

$$(1.5 \cdot 10^{15} \text{ cm} \cdot 1.4 \cdot 10^{-13} \text{ cm})^{1/2} \approx 14 \text{ cm},$$

$$(2 \cdot 10^{33} \text{ g} \cdot 9 \cdot 10^{-28} \text{ g})^{1/2} \approx 1.4 \cdot 10^3 \text{ g}.$$

The temperature which is comfortable for humans (20 ч $30^\circ\text{C} \approx 300^\circ\text{K}$) approximates the geometric mean of particular necessary boundary temperatures – the temperature of sufficiently hot solar emissions for generating and sustaining life ($\sim 6000^\circ\text{K}$) as well as the background temperature of that sufficiently cold primary – maternal – diffuse medium from which our very ‘space macro-cradle’, the Solar system, had emerged as a result of natural gravitational condensation (~ 3 ч 30°K):

$$[(3 \text{ ч } 30) \cdot 6000]^{1/2} \text{ }^\circ\text{K} \approx (15 \cdot 6000)^{1/2} \text{ }^\circ\text{K} \approx 300 \text{ }^\circ\text{K}.$$

And, finally, the average human lifespan (~ 70 years $\approx 2 \cdot 10^9$ sec) is comparatively close to the geometric mean of the two extreme time periods, particularly of the time required to cross human brain (~ 10 cm) or even the whole length of human body ($\sim 2 \cdot 10^2$ cm) - if not with the maximum velocity of nerve impulse propagation $V \approx 10^4$ cm/sec (10^{-3} ч $2 \cdot 10^{-2}$ sec) then, at least, with the maximum velocity of the transport of chemical substances via blood circulation $V^* = 50$ cm/sec (~ 4 sec), on the one hand, and the lifespan of our own ‘space macro-cradle’ or even the whole Metagalaxy directly observed by us ($\sim 3 \cdot 10^{10}$ years $\approx 9 \cdot 10^{17}$ sec), on the other hand:

$$(4 \cdot 9 \cdot 10^{17})^{1/2} \text{ sec} \approx 1,8 \cdot 10^9 \text{ sec} \approx 60 \text{ years}.$$

For the actual process of cognition of the whole Universe, it is the Man (anthropos), being a part of a certain macrocosm and directly observing this macrocosm at the moment while trying to “look” (to mentally penetrate) both into himself, his own microcosm, and beyond – into the macrocosm (up to the all-encompassing megaworld), and not only into their present but also into their past and their future, – it is Man who is the most essential in the infinite Universe which is being cognized by him, with its typical macro-micro symmetry. And this is what the so-called the Anthropic Cosmological Principle (ACP) [29] is about, which I was actually the

first to have introduced into modern cosmology in 1957/59, 1958 [2, 3] and which was later rediscovered and reformulated independently by Robert Dicke, Brandon Carter, and many others [7].

However this principle only derives its universality from the systems discovered by the author – logical, theoretically well determined, interrelated, and periodical - cyclically closed. These are the systems of the prototypal fundamental structural elements of the matter at each of the four possible successive basic levels of its natural self-organization – physical, chemical, biological, and, finally, psychological (i.e. conscious or mental – the most **fundamental, underpinning all** others) [11-13].

References

1. *Idlis G.M.* The Cosmic Matter / Responsible editor Academician V.G.Fesenkov. Moscow: USSR Academy of Sciences, 1957. 126 p. (in Russian)
2. *Idlis G.M.* Structural infinity of the Universe and Metagalaxy as a typical inhabited cosmic system (Abstract) // Transactions of the VIth Conference on the Issues of Cosmogony Труды (Moscow: 5 – 7 June 1957). Extragalactic astronomy and cosmology. Moscow: USSR Academy of Sciences, 1959. P. 270–271. (in Russian)
3. *Idlis G.M.* The main features of the observed astronomic Universe as typical properties of inhabited cosmic system // Proceedings of the Astrophysical Institute of the Kazakh SSR Academy of Sciences. 1958. Vol. VII. P. 39–54. (in Russian)
4. *Carter, B.* Large number coincidences and the anthropic principle in cosmology // Cosmology: Theories and observations. Moscow: Mir, 1978. P. 369–379. (in Russian)
5. *Zeldovich Ya.B.* The birth of a closed Universe and the anthropic principle. // Pisma v Astronomicheskii Zhurnal (Letters to Astronomic Journal).1981. Vol. 7. No. 10. P. 579–581. (in Russian)
6. *Sakharov A.D.* Cosmological transitions with a change in metric signature // J Exp Theor Phys. 1984. Vol. 87. Iss. 2 (8). P. 375–383. (in Russian)
7. *Barrow John D. and Tipler Frank J.* With a foreword by John A. Wheeler. The Anthropic Cosmological Principle. Oxford: Clarendon press. 1986. XX + 706 p.
8. *Idlis G.M.* The revolution in astronomy, physics and cosmology. Moscow: Nauka, 1985. 232 p. [See also the second edition, revised and updated. Moscow: URSS (LKI), 2008 (in print)]. (in Russian)
9. *Idlis G.M.* On the main principles and results of the general theory of the scientific management of labor and the optimal structure of scientific research institutes // Vestnik AN Kazakhskoi SSR (Herald of the Kazakh SSR Academy of Sciences). 1966. No. 4. P.18–34. (in Russian)
10. *Idlis G.M.* The mathematical theory underlying the scientific management of labor and the optimal structure of scientific research institutes. Alma-Ata: Nauka Kazakhskoi SSR. 1970. 336 p. [See also the second edition, revised and updated. M.: URSS (LKI), 2007. 368 c.]. (in Russian)
11. *Idlis G.M.* The unity of natural science according to Bore and the uniform interrelated periodic systems in physics, chemistry, biology and psychology. I / II // Studies on the history of physics and mechanics. 1990 / 1991–1992 // Moscow: Nauka, 1990 / 1997. P. 37–78 / 101–187. (in Russian)
12. *Idlis G.M.* Mathematical Principles of Science of Sciences and Unity of Principle of Systems of Fundamental Structural Elements of Matter at All Successive Basic Levels of Its Natural Self-organization // 8 International Congress of Logic, Methodology and Philosophy of Science (Moscow, USSR, 17 – 22 August 1989). Abstracts. Vol. 5. Part 5. Moscow: “Nauka”, 1987. P. 122–125.
13. *Idlis G.M.* The Uniform Interrelated Symmetric Periodic Systems of Fundamental Structural Elements of Matter at Four Successive Basic Levels of Its Natural Self-organization (in Physics, Chemistry, Biology and Psychology) // Symmetry of Structure (Interdisciplinary Symmetry Symposia, I) (Hungary, Budapest, 13 – 19 August 1989). Abstracts. Vol. I. Budapest: International Society for Interdisciplinary Studies of Symmetry (SISS), 1989. P. 242–245.
14. *Idlis G.M.* On the mathematization of science of science (axiomatic grounds) // Philosophy and sociology of science and technology. 1987. Moscow: Nauka, 1987. P. 114–136. (in Russian)

15. *Idlis G.M.* From the anthropic principle to the intelligent primal source // Global evolutionism (philosophical aspect). M.: Institute of Philosophy, Russian Academy of Sciences, 1994. P. 124–139. (in Russian)
16. *Idlis G.M.* The Supreme Intellect or Thinking Universum as an indispensable special (ultimate and, at the same time, initial) fundamental, prototypal structural element of the matter // Interrelations between the physical and religious worldviews. Theoretical physicists [talking] about religion. Iss. 1/ Compiling editor Doctor of Physical and Mathematical Sciences, Professor Yu.S.Vladimirov. Kostroma: MIITsAOST, 1996. P. 126–137. (in Russian)
17. *Idlis G.M.* Logical cyclic repeatability of the leaps in the development of science, correlating with solar activity // History and methodology of natural sciences. Iss. XXII. Physics. Moscow: Moscow University, 1979. P. 62–76. (in Russian)
18. *Idlis G.M.* The cosmic – solar – pulse of Life and Intellect (All in good time...). Moscow: URSS (LKI), 2008. 216 p. (in Russian)
19. *Idlis G.M.* The universal nature of cosmic civilizations and the necessary universality of the anthropic principle in cosmology // Ancient astronomy: the Sky and the Man. Conference proceedings. The round table “Issues of paleoastronomy (archaeoastronomy)” Moscow, Shternberg State Institute of Astronomy (GAISH MGU), Moscow State University, 9 – 24 November 1987). Moscow: Chelovek K^o, 1998. P. 138–145. (in Russian)
20. *Idlis G.M.* Universality of space civilizations and indispensable universality of the anthropic principle in cosmology // Astronomical and Astrophysical Transactions. 2001. Vol. 20. Issue 6. P. 963–973.
21. *Idlis G.M.* Natural science as a unified – principally holistic – science of the Nature: the unity of the material and the ideal (historical and logical aspects) // Studies on the history of physics and mechanics. 2000. Moscow: Nauka, 2001. P. 205–227. (in Russian)
22. *Idlis G.M.* In search of truth. Moscow: Agar, 2004. 190 p. (in Russian)
23. *Tomilin K.A.* The fundamental physical constants: historical and methodological perspectives. Moscow: PHYSMATLIT, 2006. 368 p. (in Russian)
24. *Idlis G.M.* Causality as a basis of cosmology. // Proceedings of the Astrophysical Institute of the Kazakh SSR Academy of Sciences. 1961. Vol. XII. P. 37–55. (in Russian)
25. *Idlis G.M.* The universal cosmological principle and the universal world constants // S.I.Vavilov Institute for the History of Science and Technology. Annual Scientific Conference. 1999. Moscow: Editorial URSS, 2000. P. 197–200. (in Russian)
26. *Idlis G.M.* The theory of relativity of structural infinity of the Universe // *Astronomicheskii Zhurnal* (Astronomical Journal). 1956. Vol. XXXIII. Iss. 1. P. 20–26. (in Russian)
27. *Idlis G.M.* Space and time: the issues of their interconnections, symmetries, differences, and determinacy // Infinity in mathematics: the philosophical and mathematical aspects / Ed. by A.G.Barabashev. Moscow: Yanus-K, 1997. P. 338–345. Paper presented at the All-Russia Conferences on the Issues of Infinity in Mathematics (September 1995; September 1996). (in Russian)
28. *Idlis G.M.* On the structure and dynamics of Metagalaxy // Philosophic issues of Einstein’s gravitation theory and the relativistic cosmology. Kiev: Naukova Dumka, 1965. P. 302 – 312. Paper presented at the respective All-Union Symposium (Kiev, 1964). (in Russian)
29. *Idlis G.M.* Logical “chronology” (chronicle – history – and logic) of the radical revision of relations between and the nature of main categories of natural science // Studies on the history of physics and mechanics. 2005. Moscow: Nauka, 2006. P. 292–345. (in Russian).