

If the actual Universe is a Gödel Universe?

If the actual Universe is a Gödel Universe, one consequence would be the unreality of time or an absurd time structure, even for Gödel (1949/1970) himself. According to Gödel, due to the relativity of simultaneity, we cannot objectively establish linear time series, and, therefore, time is not real, at last, the intuitive idea of time:

The assertion that the events A and B are simultaneous (and, for a large class of pair of events, also the assertion that A happened before B) loses its objective meaning, in so far as another observer, with the same claim to correctness, can assert that A and B are not simultaneous (or that B happened before A). (Gödel, 1949/1970, p.557).

Therefore:

Each observer has his own set of “nows”, and none of these various systems of layers can claim the prerogative of representing the objective lapse of time. (GÖDEL, 1949/1970, p. 558).

I believe, nonetheless, we can consider an intuitive time structure based on a Gödel Universe. Seems yet not impossible or absurd to discover that our Universe is actually a Gödel Universe¹. Time cannot exist in common sense in a Gödel Universe, but a Gödel universal structure can be real.

In Gödel’s rotatory Universe, for any temporal attribution from a referential frame, there is a different temporal attribution from another referential frame as legitimate as well. Nonetheless, for the traveler's body, time is always positive. This point has crucial relevance for clarifying

¹ While Gödel had admitted that probably our Universe is not a Gödel’s Universe (even under the in-expansion version), being enough for him to argue that there is a possible world where it is the case, recent discoveries has found evidence for rotatory structures which suggested that our Universe could be at all a type of Gödel’ Universe. See Wang, P., Libeskind, N.I., Tempel, E. *et al* (2021).

possible metaphysical confusions we can do considering Gödel's argument. In Einstein's reply to Gödel's essay, in the same book that Gödel writing it, we found a good guide for the metaphysical issues about time and causality that I am referring to.

The issue pointed by Einstein (1949/1970, p. 688) is the following: the traveler's body in a Gödel Universe is a massive body running across high distances with a positive signaling time. If we consider any body, small distances, and certain types of retrocausality, we will reach absurdity, contra-intuitive structures, or paradoxes. But if we consider massive bodies in high distances with a positive directed cone of light, there are no metaphysical or physical problems. According to Einstein: "what is essential in this is the fact that the sending of a signal is, in the sense of thermodynamics, an irreversible process, a process which is connected with the growth of entropy" (Einstein, 1949/1970, p. 688). But, Einstein advance, for a cosmological scale, the challenge to the order of time is sustained.

Contrary to Einstein, I believe that localized inverse directions of entropy are necessary to make sense of the causal structure of the Gödel Universe and we can do that while we maintain the positive direction of the light cones and signaling. A galaxy, star, or cluster of galaxies, let us call a Gödel's body, must follow a tendency to reduce its entropy after cross the called critical ray in a Gödel Universe, when the light cones begin to run in the opposite direction from it is running in the present moment. Thus, in this sense, this body needs to "rejuvenate", to reach a state compatible with what we consider from here the early stages of the universe when the entropy was lower. In both entropic directions, however, the direction of the light cone, i. e., the direction of signaling, is positive and unidirectional. From entropic opposite directions do not follows opposite directions of signaling. We experience that both in classical and in the quantum domain. We can arrange a process where the entropy of the system will evolute to a lower entropy, but we cannot send signals to the opposite direction of time, maintaining, in this way, the positive cone of light for any body in any stage in a Gödel Universe.

Nonetheless, we must say that in a Gödel Universe some type of signal (if we consider a Gödel's object a signal itself) is sent from a present moment toward a moment that is early than now. Yet, this "signaling" must be distinguished from signaling from near distances in a direct retrocausal process. Sending a signal from now toward four days ago is different from a cyclical process of an entire galaxy or cluster of galaxies. In Gödel's Universe, we maintain each partial structure of a time series (the world line of an object) intact as bricks in a bigger cyclical series

structure, while in nearly closed curves this partial structure collapses, and, therefore, the time itself. The time would be also non-existent in a Gödel Universe in the sense that an early event would be also a later event. Nevertheless, we can imagine a whole solid temporal structure for this Universe, even considering that result. We cannot do the same for nearly closed time curves.

While we are distinguishing the partial linear structures and the biggest closed time curves in which these partial time-lapses are composing, cyclical Universes or big causal loops do not originate paradoxes and would be even more intuitive than their pairs, like a Universe appearing from nothing. Note that we need not a whole cyclical Universe, but rather big closed cyclical structures in a rotatory Universe, to have a Gödel Universe. There is more than one solution that we can consider as a type of Gödel Universe. Gödel himself presents two: a static one and an in - expansion one. We can similarly, under experimental evidence, consider new reformulations or solution adaptations, so far it keeps the essence of Gödel Universe: big closed time curves for large bodies in a rotating structure. In fact, these Universes would be different from our occidental common conception until here, but they would be not impossible, absurd, or contra-intuitive.

References

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