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## Birth of the Universe and Multiverse

The Big Bang model is the standard theory of the universe. This model has been strengthened by the development of particle cosmology. According to the modern paradigm of cosmology, the universe was created from “nothing” by quantum gravity effect. The created universe expanded exponentially, and successively, was heated up (1). Then, the hot Big Bang universe was formed. This scenario is called the inflation model now. Soon after the inflation model was proposed, we showed the original “mother” universe gives birth to child-universes copiously via formation of wormhole-like geometry by the nucleation of vacuum bubbles during the inflation period(2). The child-universes give birth to grand-child universes, and so on. The picture of existence of multi universes is called multiverse. At present, the multiverse is predicted by the super string theory too, which is believed as the most plausible model of the unified theory of basic interactions.

On the other hand, it has been known the initial conditions of our universe and basic laws of physics are precisely tuned as if life and humankind are surely born in our universe. Anthropic principle on the basis of multiverse explains this miraculous fine tuning: Assume there exists almost an infinite number of universes in which physical laws are different from each other. The universes which existence are recognized are the only ones in which intelligent life (such as humankind) is born. The physical laws of their universe were the laws selected by chance, to which intelligent life was permitted to be born. Then, the physical laws found by intelligent life are fine-tuned ones naturally as if God designed to create them.

In this talk, research on the birth of the universe and multiverse, and the anthropic principle, are reviewed.

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## References

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## CV

1976-1982	Assistant Professor, Faculty of Science, Kyoto University.
1982-1990	Associate Professor, School of Science, The University of Tokyo.
1988-1991	President, Commission Cosmology, International Astronomical Union.
1990-2009	Professor, School of Science, The University of Tokyo.
1997-1998, 2005-2006	President, Physical Society of Japan.
2001-2003	Dean, School of Science, The University of Tokyo.
2010-Present	President, National Institutes of Natural Sciences.