

Our Amazing Universe

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Two major science revolutions in the 20th century, theory of relativity and quantum mechanics, have drastically changed our understanding of the universe at the very large and the very small, respectively. These are extraordinary accomplishments of human intelligence. Yet the two theories cannot yet be successfully merged together. Entering the new century, we suddenly recognized that all the hard-earned knowledge of the fundamental building blocks of nature contributes only less than 5% of the total substance of the universe. The remaining 95% are contributed from dark matter and dark energy, whose nature is still unknown. Aside from the composition issue, we know that the Universe began with a Big Bang and a inflation, but the detailed nature are still unresolved. To reach a deeper understanding of the early universe, a quantum theory of gravity that unifies general relativity with quantum theory may be necessary. The challenge for our understanding of the late universe is equally severe. What exactly is dark energy made of, and what will be the fate of our Universe?

Our Universe is also full of amazing extreme phenomena: the extremely high energy cosmic rays and neutrinos, the supermassive black holes that exist in most galactic centers, gamma ray burst, the most violent explosions second only to the Big Bang, etc. We now also know that there exist way more exo-planets than we had imagined. All these have triggered more questions. Is there other intelligent life in this Universe? Are there really space-time extra-dimensions? Is time travel possible? Is the Universe unique or are there other universes (multiverse)?

In this lecture I will tour you through our amazing universe!