

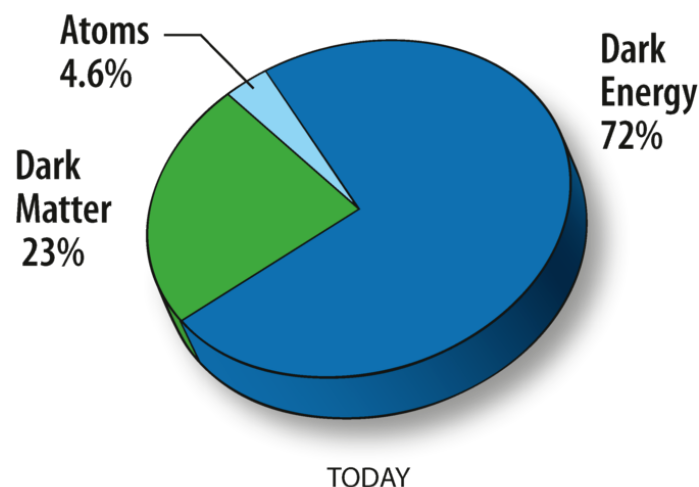
Dark energy, modified gravity, and large-scale structure

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The Universe we see around us, when interpreted within the context of Einstein's theory of General Relativity, suggests the presence of a pervasive fluid of *Dark Energy*. This mysterious substance, which acts repulsively under gravitational interactions, is hypothesized in order to force the rate of expansion of the Universe to accelerate. Such acceleration has now been observed in a large number of independent cosmological observations, but the existence of Dark Energy nevertheless provides extreme challenges for our understanding of theoretical physics. As such, it becomes essential for us to make sure that we understand precisely how gravity works on the scale of the observable Universe, and to ensure that it is properly tested.

During this project, the PhD student will investigate the ways in which alternative theories of gravity operate in the cosmological context. This could include:

- Studying the Friedmann equations of alternative theories of gravity, and the degree to which they can produce a universe with an accelerating rate of expansion.
- Studying the growth of large-scale structure in alternative theories of gravity, and how this differs from the standard picture of structure formation in general relativity.
- Constructing frameworks for understanding gravity in a theory-independent way, thereby allowing cosmological observations to constrain the gravitational interaction.
- Developing techniques for discovering and understanding the new gravitational phenomena that can occur in modified theories of gravity.



Note: This project description can be used for the "Research Proposal" part of your application.