Theoretical approaches to cosmic acceleration: Connecting string, supergravity and quantum field theory aspects of (near-) de Sitter space

3 - 7 July 2017 @Oort

Cosmological observations provide strong evidence for the presence of positive vacuum energy density in our universe. This is so at early times (*cosmic inflation*) and at late times (*dark energy*). The vacuum energy is the reason why the expansion accelerates. While many simple models can account for the phenomenology of accelerated expansion, embedding such models into a fundamental, consistent theoretical framework poses one of the main challenges in theoretical physics today. This Lorentz Center workshop was a focused attempt to make progress in this very difficult problem.

The workshop brought together a small group of experts, both from a top-down (string theory and supergravity) as well as a bottom-up quantum field theory / effective field theory (EFT) perspective. There had been recent, independent theoretical developments in both approaches, and our challenge was to communicate these efficiently across subdisciplines.

We experimented with a format that would maximize discussion and it turned out to be exactly what was required. Each day focused on a different subtopic. It started with a 1.5 hour detailed review by one of our (younger) experts, including approximately 30 min for questions and discussion. After that, there were a few research talks and each day ended with a long discussion session led by a senior scientist. Some weeks before the start of the workshop, the leaders of the discussion sessions had been asked to coordinate with their corresponding morning reviewers to try to identify ahead of time some of the important open questions where progress could be made. These topics were put on the agenda for each day's discussion session, and the remaining time was dedicated to any other issues that had come up during the day.

The result was excellent. The workshop drew a much larger number of participants than the forty we had initially planned for, and the atmosphere in the Gratama room was both relaxed and exciting. There were so many questions and comments that we kept going overtime, but the program was flexible enough to accommodate these changes. Discussions and collaboration continued during coffee and lunch breaks, also involving students and early-stage researchers. Most importantly, new ideas and collaborations have emerged as a result (some research papers explicitly acknowledge the hospitality of the Lorentz Center). And we have made progress in technical questions like the relation between nilpotent superfields, supersymmetry breaking and branes; or in understanding the essential role played by the field geometry in some multifield inflation scenarios.

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