

Rethinking the dark sector of the Universe - the interplay between inflation, dark matter and the Higgs boson

Summary

The PhD student will join the research program of the Estonian Research Council Team Grant PRG1055 "Beyond Einstein gravity in light of Early Universe particle physics" and study the interplay between inflation, dark matter and Higgs vacuum stability in theories of gravity beyond Einstein's general relativity.

Research field:	Earth sciences
Supervisor:	Antonio Racioppi
Availability:	This position is available.
Offered by:	National Institute Of Chemical Physics And Biophysics
Application deadline:	Applications are accepted between May 03, 2021 00:00 and May 31, 2021 23:59 (Europe/Zurich)

Description

In the last century, enormous progress has been made in understanding particle physics and cosmology. The standard model of big bang cosmology provides good agreement with the observed properties of the Universe while the standard model of particle physics appears to be a quite accurate description of high energy physics according to the most recent LHC data. Unfortunately, there are still several unsolved puzzles. A detailed comprehension of cosmic inflation is lacking. The dark matter paradigm is not known. The world as we know it may collapse in a cataclysmic crunch due to an inherent instability of the Higgs boson vacuum. This project will study the interplay between inflation, dark matter and Higgs vacuum stability in theories of gravity beyond Einstein's general relativity (in particular the Palatini formulation).

The PhD student will join the Laboratory of High Energy and Computational Physics at the National Institute of Chemical Physics and Biophysics. This highly qualified and motivated international team has on-going collaborations with top international institutes and is actively investigating a broad range of topics, linking particle and astro-particle physics and cosmology. The projects related to the topic are the Estonian Research Council Team Grant PRG1055 "Beyond Einstein gravity in light of Early Universe particle physics" and the Centre of Excellence TK133 "Dark Side of the Universe".

The PhD student will first actively contribute to the research program about inflation of the PRG1055, as it requires less background studies. Later on, the PhD student will also join the dark matter and Higgs boson studies. The PhD student is expected to write a minimum of 3 ISI WoS papers and disseminate the results via (on-line when needed) conferences, workshops and seminars.

Applicants should fulfil the following requirements:

- Master's degree in Physics
- speaking and writing in fluent English
- good skills in mathematics and programming
- basic understanding of special relativity, particle physics and quantum field theory
- strong self-learning and collaborative working abilities



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