Work Project Report

Mikhail M. Ivanov
CERN Summer Student 2013
Supervisors: **Vyacheslav Rychkov** and **Diego Blas** (*Theory Division*)

The aim of the project was to study Boltzmann code CLASS (developed by J. Lesgourgues) and adapt it for non-standard cosmological scenarios. At the second point it was proposed to compare predictions of the non-standard models to CMB and LSS data using parameter inference code *MontePython*.

During eight weeks from 1st July to 23rd of August 2013 the following results have been achieved:

1. CLASS code *version*1.7 was adapted for cosmological model with Lorentz violation in the Dark Matter sector, proposed in [JCAP **1210**(057)].

2. I have found initial time for simulations, leading to accurate initial conditions providing us with stable results.

3. Observable effects in CMB and LSS have been revealed and explained. It was shown, that the main signature in Cosmic Microwave Background is enhanced Integrated Sachs-Wolfe contribution and the main modification in structure Power Spectrum is scale-dependent amplification for short modes.

4. Monte-Carlo simulations, based on modified CLASS code have been launched two weeks ago and are still converging. For Monte Carlo Markov Chains we use latest *MontePython* v1.2 code with Planck data likelihood. We expect to obtain final results in the coming days.

First three points in the list have been investigated directly by me and the last point (Monte Carlo simulations) now is under investigation in collaboration with J. Lesgourgues (CERN), B.Audren (EFPL).