

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA18108 - Quantum gravity phenomenology in the multi-messenger approach

STSM title: QG with future cosmological data

STSM start and end date: 06/01/2020 to 04/03/2020

Grantee name: David Benisty

Purpose:

One from the basic features of our nature is the Newtonian Constant. This constant in many QG models is not a fundamental constant but some running field. The effect of this Running Newtonian Constant may be detected in future observations such as the phase of the gravitational waves. Future observations of Dark Energy Survey may detect those cosmological effects as well. The purpose of my visit was to establish the connection between those theories and impact on future cosmological detection. At the beginning of the STSM we decided to apply similar methods but on a different data set: from the far future measurements of gravitational waves by Lisa, but on closer measurements by Dark Energy Survey. It is apparent to be more useful for the close research.

Work carried out:

In the recent two month we continue our work on the Local Group of galaxies and the impact of the cosmological constant on the predicted mass. I studied as well how to use python packages as Polychord and GetDist to plot statistical results. Moreover, I studied basic stuff as Bayes Theorem in order to understand the foundations of observational cosmology. Those tools gave me the basis to emphasize data fit with the recent result of DES with different gravity models.

Main results obtained:

We finished our last work about the LG mass. We obtain the impact of the cosmological constant on the Andromeda mass with the recent Gaia based measurements. We began our discussion about the possible model to constraint QG and modified gravity models using DES data with simple results. We obtained the connection between the running Newtonian Constant for instance in some theories of gravity and their effects on cosmological effects. For instance, the effect of Running G on the homogeneous expansion should modify the Friedmann equations and hence the cosmological parameters. So future observations would lead to stronger constraints on those parameterizations.

Future Collaboration:

The data of DES is ongoing for 6 years and we have so far, the data for the 1st year, with the models we want to test. This is a continuous research that the last 2 months have been the basis for. When the first publication will appear, we will mention the contribution of STSM COST QG action.

I would like to add that this was the first time I studied to use Python. In those two months I studied the basis for statistical analysis in cosmology and how to use them. This studying related very much for both to the research proposal we wrote at the beginning and the data set we decided to focus eventually. I have already final results for the LG mass statistics and the theoretical connection between some gravity models and the effect on the cosmological parameters. But this is an ongoing research.