



Grant Number: FAPESP#2015/50009-0	Principal Investigator: Nural Akchurin
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1 - Please, analyze the progress of the project, the results and publications resulting from it.

The TTU-SPRACE (Sao Paulo Research and Analysis Center) collaboration performed searches for dark matter (DM) in proton-proton collisions at the Large Hadron Collider at CERN in Switzerland under this grant. Members in the TTU group were pioneers of the DM searches at the LHC and published the first result from the LHC on DM using the 2011 data. After the discovery of the Higgs particle in 2012, dark matter became a primary objective in research at the LHC and the TTU-SPRACE formed a strong research team in 2015 under this grant and worked with the CMS collaboration.

The CMS collaboration took new data in 2016, which were taken at 60 % higher beam energy and twice in data size than previous datasets. Preliminary results were presented at ICHEP 2016 (38th International Conference on High Energy Physics) and other international conferences in summer of 2016. A paper based on the partial 2016 data has been published in a journal (JHEP) and another paper with full data will be submitted to a journal (PRD) shortly. The results were presented at numerous conferences as a part of results from the CMS experiments by CMS collaborators and TTU-SPRACE members.

SPRACE members visited TTU in July 2015 and August 2016, and TTU members visited SPRACE in May 2016 and May 2017 to develop software tools and plans for data analysis. The group had weekly meetings using a video conference system to discuss on-going analyses. In addition, members from both groups visited CERN in September 2016 and July 2017 to exchange technical information and develop plans for further analysis with CMS collaborators at CERN. Those visits and video conferences were very effective to boost the collaborative research.

The LHC provides new collision data in 2017 and 2018 before a following long shut down for its upgrade. The TTU-SPRACE group continues searches for DM in the new data. In addition, the group started collaborating on searches for Graviton at the LHC. A PhD student at SPRACE completed a related research for his thesis this year and a PhD student at TTU is now working to improve the sensitivity to Graviton produced at the LHC. Many of techniques to search for DM and Graviton are common and the TTU-SPRACE group has accumulated the knowledge and techniques in this area of research. Now the group is developing a coherent research program to study DM and Graviton using the LHC data. The group is ready to move to the next level of research with new data and advanced techniques.

2 – If resources have been granted for participation in scientific meetings, please review the relevance of the work presented.

The TTU-SPRACE members presented results from the CMS experiment at various conferences including results from the work under this grant. The group did not spend significant funds in participating in scientific meetings on this particular grant and the travels were supported by other grants (generally the Department of Energy grant for the TTU group) for the CMS activity.

3- Participation in scientific or technological meetings

Does the importance of the meetings justify the expenses listed in the report?
 Yes No

Was there participation in congresses without presentation of work?
 Yes No

If so, please discuss the exceptional conditions justifying such expenditure.

4 – Visits to the Brazilian partner

Was the visit of appropriate duration?

Yes No

Did the Brazilian partner dedicate enough attention for scientific discussion during the visit?

Yes No

If not, please comment on it.

Did the outcome justify the visit?

Yes No

If no, please comment on it?

In the case of other participants in the research proposal (professors or postdocs) who also visited the Brazilian partner. Did the outcome justify the visit?

Yes No

If no, please comment on it?

5. Final Analysis

Progress Report Approved

Progress Report Approved with criticisms or suggestions that should be considered in the next scientific report

Progress Report not Approved

Final Report Approved

Final Report Not Approved

INFORMATION FOR THE EXCLUSIVE USE OF TTU

The content of the previous items may, at TTU's discretion, be sent in full to the PI.

If you wish to add information considered important for TTU to support your decision and should not be transcribed to the PI by its confidential nature, include them in this space.

THIS ADVISORY IS COMMITTED TO MAINTAINING THE CONFIDENTIALITY OF THIS
REVIEW

I declare that there is no circumstance characterizing a situation of potential conflict of interest or that it may be perceived as an impediment to an exempt opinion. I undertake to keep confidential all the information in this case, in particular my advisory status and the content of this report.

Advisory Institution:

Name:

Place, date and signature: