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REQUEST FOR PARTICIPATION OF INTERNATIONAL PARTNER COUNTRY  
TO COST ACTION CA18108, QUANTUM GRAVITY PHENOMENOLOGY IN THE MULTI-MESSENGER  
APPROACH

### 1. 1. MANAGEMENT COMMITTEE AND Head Of Science Operations APPROVAL

The COST Action CA18108 Management Committee approved By Written Procedure on 5 March 2020, the request for a International Partner Country participation, based on scientific merits.

#### Name of International Partner Country

NAME	York University
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#### Name of representative to COST Action CA18108

DEPARTMENT	Department of Physics and Astronomy
NAME	Prof Saeed Rastgoo
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Request validated by COST Association Science Officer Dr Ralph Stuebner

This request was reviewed by the COST Head Of Science Operations, and validated on 19 March 2020, based on the scientific merits.



## **2. PRESENTATION OF INTERNATIONAL PARTNER COUNTRY AND ITS REPRESENTATIVE**

York University is a research-intensive institution known for championing new ways of thinking that drive teaching and research excellence. It is Canada's third-largest university, with two campuses in Canada and two international campuses. It has 39 research chairs, 29 research centers. It has ranked 7th in 2020 Comprehensive Universities in Canada according to Maclean's. The Department of Physics and Astronomy at York University has more than 85 professors working on various research topics in theoretical, experimental and computational physics, including gravitational physics and astronomy. The Department has strong collaborations with Perimeter Institute for Theoretical Physics and Waterloo University, among others. The nominated representative is Dr. Saeed Rastgoo. He has obtained his PhD under the supervision of one of the world leaders in Loop Quantum Gravity (LQG), Prof. Rodolfo Gambini, and collaborating with Prof. Jorge Pullin of Louisiana State University. His work led to the discovery of new variables for the CGHS model making it possible to quantize the model using nonperturbative methods. He also discovered phenomenological signals regarding the interaction of matter with quantum black holes. He then did two postdocs in Mexico in the renowned UNAM and then at Universidad Autonoma Metropolitana in Mexico City. While in Mexico, he was designated as a member of the "National System of Researchers" and was assigned to various committees of CONACyT to evaluate research projects for grants. In October 2018, Dr. Rastgoo became an Assistant Professor at the Monterrey Institute of Technology in Mexico which is among the top 3 Universities of the country. After little than a year, on January 2020, he started his new position at York University in Canada as an Assistant Professor. Dr. Rastgoo's research is focused on fundamental and phenomenological aspects of quantum gravity, particularly quantum black holes as well as the fine structure of spacetime. He has various important papers on singularity resolution in quantum black holes, and phenomenological aspects of the interaction of matter with such black holes. He has also found a strong bound on the minimum scale in a quantum spacetime by combining theory with experimental data of the GRBs from Fermi Observatory. Furthermore, Dr. Rastgoo has discovered new variables that enables one to quantize not only the CGHS model, but a large class of dilatonic black holes in a nonperturbative manner, thereby opening the door to the fundamental and phenomenological studies of such black holes in quantum or effective regime. He has also developed a model for the fine structure of spacetime, with a strong potential to resolve some of the issues related to black holes, their singularities and their paradoxes. Dr. Rastgoo is in the process of creating a strong quantum gravity group at York University, with the aim of working on both fundamental and phenomenological aspects of this subject. Currently he has various projects with regard to phenomenology of quantum black holes, gravitational waves signatures that can reveal the quantum nature of spacetime, and fundamental aspects in physics of quantum spacetime and quantum black holes.

## **3. BACKGROUND INFORMATION**

Dr. Rastgoo is currently in the process of creating a new Quantum Gravity Group at York University which will be the only such group among the Universities the Toronto area. His long-term goal is to develop this group into a node in research on quantum gravity in Canada. The membership to the COST Action will connect this group and more inclusively the Gravity Group at York University with several important international collaborating institutes. It will also help in attracting more graduate students interested in research on theoretical and phenomenological aspects of quantum gravity and black holes to York University. Moreover, it will greatly help in strengthening the ties between the Gravity Group and the Astronomy Group which has various projects in theoretical/experimental subjects related to compact objects. Membership of COST will also increase the visibility and reputation of York University among the international research community working on quantum gravity. Furthermore, the training schools of the Action will serve as excellent opportunities for students and faculty of York University to bring their knowledge up to date, and create and strengthen strong collaborations with international distinguished partners that are member of the Action. By hosting Short Term Scientific Missions of COST at York

University, not only the local students and faculty can be inspired and connected to the guest European partners, but also new collaborations can be forged with such partners.

#### **4. DESCRIPTION OF MUTUAL BENEFITS**

##### **4.1 Benefits for COST and for the COST Action**

Dr. Saeed Rastgoo, representing York University in Canada, has worked on fundamental and phenomenological aspects of quantum gravity, specializing in loop quantum gravity, quantum black holes and their interaction with matter, and in theoretical models about the fine structure of spacetime. His participation in our COST Action would help to build a bridge between fundamental features of quantum gravity and the phenomenological traces they might leave in cosmic messengers, particularly in gravitational waves. Prof Rastgoo is at present creating a research group of quantum gravity in York University and the participation of this group in the COST Action would be mutually beneficial.

##### **4.2 Benefits for the International Partner Country**

Canada has several institutions and a large community working on black hole physics in classical/quantum regime. However, at the moment there are only two academics that are members of the COST action and they are from the same University (actually one member used to be a PhD student of another member, and is now a seasonal assistant professor at his University where he received his PhD degree). Given the huge potential of both Canada's gravity community and COST action, it is very beneficial for Canada to have more members in the COST action, especially from Ontario and particularly from Toronto area, where the scientific community is very large. It is also very useful since Canada is geographically very large and having members from different locations in Canada helps boost overall connection of Canada's scientific community with the COST action.

##### **4.3 Brief description of targeted scientific activities, including Working Groups selected for cooperation**

The working group that the MC observer will participate in are as follows: • WG1: Theoretical frameworks for gravity effects below the Planck energy • WG2: Phenomenology of quantum gravity • WG3: Gamma rays • WG6: Gravitational waves The MC observer also would like to participate in any scientific activity that is related to the above working groups that are allowed under the regulations of the COST action, including conferences, training schools and workshops, and on-line meetings

#### **5. ADDITIONAL COMMENTS / REMARKS**

Not required.