



IMU-CDC Individual Research Travel Support Program
Activity Reporting Form

Name of Grantee: **NIBIRANTIZA Aboubacar**

Home Institution And Country Of Grantee: **University of Burundi, Burundi**

Name of the Host: **Frédéric Faure**

Name of the Host Institution and Country: **Université Grenoble Alpes, France**

Topic of the Research Activity: **Connection between physics and geometric quantization**

Dates spent Center/Host Institution: **04-04-2022 to 06-07-2022**

1) My stay at the University of Grenoble Alpes in the laboratory of the Institut Fourier I learned to carry out numerical simulations in quantum mechanics with the Python language: the resolution of the spectrum of the Harmonic oscillator, computations and drawing of stationary states, Evolution of an atomic wave packet in a molecule, comparison with the classical trajectory. Geometric quantization corresponds to the spreading of the packet, interference, tunnel effect and this will allow me to take another step in research in mathematical physics.

2) Research projects that are in progress, in collaboration with Frédéric Faure: **Spectrum of Hecke operators of $SU(2)$.**

We compute the spectrum of the Hecke operators to study the spectral radius: we first use a numerical simulation of its spectrum and then we verify our conjecture by showing that the spectral radius of the Hecke operators presents a spectral gap. Once the results are complete, we will do the same study on the non-compact case of $SL(2, \mathbb{C})$.

We planed to study the spectrum of Hecke operators considering others compact (or not) Lie groups.

3) I also collaborated with doctoral students from the Institut Fourier laboratory through:

(i) local comprehensible seminars organized each week,

(ii) the conferences organized in Obernai(France) from May 31, 2022 to June 03, 2022 and in Peyresq (France) from June 20, 2022 to June 24, 2022. The stays for these periods were financed by the Laboratory of Mathematics of the Institut Fourier which we would like to sincerely thank.

4) I thank the IMU-Simons African Fellowship Program for having financed my stay in France. This stay allowed me to develop my research skills in mathematical physics.

With my signature I agree that my Activity Report and pictures can be published on the CDC website.

Date: July 09, 2022

Signature: