

Motivation Letter - Support Grant for a Second FRIA Application

Dear Members of the Selection Committee,

My name is Mohamed Amine Miftah, and I am currently in the first phase of my PhD in astrophysics at the University of Liège, under the supervision of Prof. Emmanuel Jehin. My research focuses on the detailed physical characterization of near-Earth asteroids (NEAs), a scientifically challenging topic with strong relevance to planetary defense and a research topic of the COMETA group.

The evaluation provided by the FNRS jury for my FRIA application was very positive and did not mention any specific weaknesses in the project. The jury indicated that the application could not be funded due to the strong competition (see FNRS report attached). I finished at a position number 5 on my jury with an A (excellent).

Since the submission of the application, I have continued to work on my research project with the aim of strengthening its scientific impact. A first outcome is a scientific paper in the final stages of preparation, a work I have started in January 2025 thanks to an Erasmus+ grant and that I presented at the EPSC-DPS joint international meeting in Helsinki in last September. This work demonstrates the feasibility of the methodology proposed in the FRIA application for one asteroid, and provides early scientific results that reinforce the credibility and expected outcome of the PhD project for many more asteroids.

The goal of my doctoral research is the detailed 3D shape modeling of a sample of about 20 NEAs using combined photometric observations using TRAPPIST telescopes and high resolution radar images from Arecibo observatory archives. This effort will approximately double the number of NEAs with high-quality shape models, enabling a statistically meaningful study of shape, size, spin-state distributions, and the YORP effect.

In addition, I have expanded the project to include polarimetric observations obtained at the ESO Very Large telescope in Chile. This work has started in collaboration with ESO astronomer Dr. Michael Marsset, with whom I have already collaborated on photometric studies of asteroids using TRAPPIST data. The new collaboration should reinforce the FRIA application, and demonstrate the strong integration of my PhD project within an international research network.

Beyond its fundamental scientific goals, my research has clear applied implications. Improving our knowledge of the physical and rotational properties of NEAs is directly relevant to planetary defense efforts. Accurate shape models and spin-state distributions are essential inputs for the optimization of mitigation strategies, such as those explored in the NASA DART and ESA HERA missions, whose outcome strongly depends on the target's physical characteristics.

Thank you for considering my application.

Sincerely,

Mohamed Amine Miftah

PhD student, University of Liege, COMETA group

mohamedamine.miftah@uliege.be