March 16, 2025

To the Director of The Institute of Astronomy and members of the Consejo Interno –

We are writing to propose a new instrumentation project. We understand that these projects should normally be submitted in the call for proposals issued by the Consejo Interno and the Comisión Asesora de Proyectos de Instrumentación (CAPI) at the end of each year. However, as the project Principal Investigator, Dr. Noémie Globus, has only recently been hired by the UNAM, this was not possible. Therefore, we are submitting this proposal in an ad hoc manner for your consideration.

We propose to replace the OGSE camera (the current engineering camera on COLIBRÍ) after the end of the commissioning phase for DDRAGO (the science camera on COLIBRÍ), by a new commercial camera with a CMOS Image Sensor pixel technology (Sony Polarsens™) that has several different angle polarizer formed on chip. This is a new sensor developed by Sony which is currently only targeting industrial equipment. This sensor captures the light polarization with a single acquisition over the entire image, pixel by pixel and can calculate real-time information about the direction and degree of polarization. We would mount a fixed r filter before the camera. The system would have no mechanisms or moving parts, and this simplification will allow us to advance quickly. The instrument will be called "TEQUILA" for "Transients Events Q, U, and I Light Analyzer".

Based on the constructor's information on this camera performance, we estimated that it will allow us to monitor in real time (1-to-3 min exposure time) the optical linear polarization of bright GRB afterglows (r of about 17) in the r filter. This would be an important step forward for GRB science, as afterglow polarization directly probes the magnetic field properties of the jet, when measured minutes after the bursts.

This technology has never been used on a telescope, so this would also serve as a test for low-cost solutions for astronomical polarimetry. It will also allow us to evaluate the degree to which we can measure and mitigate the variable instrumental polarization in a Nasmyth focal station on an alt-az telescope. This polarized camera will replace the current engineering camera on COLIBRÍ so it won't interfere with the existing science instruments. We would plan to install the camera in the fall of 2025.

The project will be led by Dr. Noémie Globus with the participation of Dr. Alan Watson mainly in the integration of the camera into the telescope control system. We will also involve our graduate students and a possible post-doc, as we feel this is an excellent project in which they can learn about instrumentation and see the fruits of their effort in a relatively short time.

We have discussed the camera with Dr. Stéphane Basa and Dr. William Lee, the PI and deputy PI of COLIBRÍ. They approve the testing of this camera on COLIBRÍ, but indicate that the status of the camera after testing will depend on the performance it achieves and its impact on other science with COLIBRÍ. If the camera remains on COLIBRÍ after testing, we will offer it to the community.

The camera will be fully funded by Noémie Globus (with her private funding from SCEECS). The labor for laboratory testing, integrating the camera into the telescope control system, commissioning, operations, and documentation will be provided by academics and students.

In terms of institutional resources, we will require access to an optical laboratory for 1 month for testing and will also likely require a mechanical adapter ring to allow us to mount the new camera on the existing OGSE mechanical structure. We estimate that the design and manufacture of this adapter will require less than 1 week of time for a mechanical engineer. We seek the approval of the Consejo Interno for the use of these resources.

Please do not hesitate to contact us if you need any additional information.

Sincerely,

Dr. Noémie Globus,
Investigadora Titular A, Instituto de Astronomía, Universidad Nacional Autónoma de México,
Co-Investigator, Simons Collaboration on Extreme Electrodynamics of Compact Sources.

Alan Watson.

Dr. Alan Watson,
Investigador Titular C, Instituto de Astronomía, Universidad Nacional Autónoma de México,
Principal Investigator, DDRAGO, COLIBRÍ Telescope.

CC:

- Dr. Stéphane Basa, PI of COLIBRÍ
- Dr. William H. Lee, Deputy PI of COLIBRÍ