

Short-Term Scientific Mission Grant - APPLICATION FORM¹ -

Action number: CA20111

Applicant name: Morgan Rogers

Details of the STSM

Title: Understanding interpretations of HoTT in elementary $(oo,1)$ -toposes

Start and end date: 22/05/2023 to 04/06/2023

A shorter, one-week stay would be acceptable if budget constraints make this length of stay impossible.

Goals of the STSM

Purpose and summary of the STSM.

(max.200 word)

The first goal is to understand the work of Rasekh and Shulman in interpreting homotopy type theory (HoTT) in $(oo,1)$ -toposes. From there, we will identify those essential features of these categories which enable interpretation of the type constructors of HoTT, with the intention of determining a broader classes of oo -categories which can model HoTT. We are particularly interested in the possibility of identifying *presentations* of categories interpreting HoTT theories, since these will facilitate explicit computations and proofs in the generated models of HoTT. These topics take advantage of the host's expertise in homotopy type theory and the visitor's experience in the internal language of toposes.

Working Plan

Description of the work to be carried out by the applicant.

(max.500 word)

The two week project will be an intensive collaboration between the host (Paige Randall North), an expert in type theory and higher category theory, and the visiting researcher (Morgan Rogers), an expert in topos theory and categorical logic. The visit will also include opportunities for the visitor to interact with other researchers at Utrecht including Jaap van Oosten, Ieke Moerdijk, Gijs Heuts, Tobias Lenz and Niall Taggart.

¹ This form is part of the application for a grant to visit a host organisation located in a different country than the country of affiliation. It is submitted to the COST Action MC via e-COST. The Grant Awarding Coordinator coordinates the evaluation on behalf of the Action MC and informs the Grant Holder of the result of the evaluation for issuing the Grant Letter.

Expected outputs and contribution to the Action MoU objectives and deliverables.

Main expected results and their contribution to the progress towards the Action objectives (either research coordination and/or capacity building objectives) and deliverables.

(max. 500 words)

This project falls under WG6: Type Theory. It mainly contributes to the following objectives:

1. "Develop a modular theory of type theories",
2. "Bring together members of the different communities working on proofs in Europe",
3. "Create an excellent and inclusive network of researchers in Europe with lasting collaboration beyond the lifetime of the Action",
4. "Actively support young researchers",
5. "Transfer knowledge in terms of expertise, scientific tools and human resources across the different disciplines and between academia and industry", and
6. "Prepare competitive EU researchers for a fruitful career in an international environment through intensive use of Short Term Scientific Missions (STSM)".

Categorical approaches to type theory are modular by construction, and categorical semantics are an important source of understanding and methods for type theory. Note that while there have been various efforts to identify the "right" definition of elementary $(\infty,1)$ -topos (a common generalization of elementary toposes and Grothendieck $(\infty,1)$ -toposes), there is no reason to assume that the internal language of these categories will precisely align with the homotopy type theory used in practice by computer scientists, so this project represents an effort to adapt the category theory literature to more closely align with the goals of EuroProofNet.

The project itself is a scientific exchange between France and the Netherlands. It will provide the visiting young researcher with lasting connections with the computer science and mathematics communities in the Netherlands. They will begin a collaboration which should lead to a publication in the short term and will contribute to the project's goals in the long term. In return, the visiting researcher will bring expertise and tools acquired in France to complement the resources and approaches available in the Netherlands.