

Short-Term Scientific Mission Grant

• APPLICATION FORM -

Action number: CA20111

Applicant name: Peter LeFanu Lumsdaine (Stockholm University)

Details of the STSM

Title: Comparing notions of dependent algebraic theory

Start and end date: 05/03/2023 to 05/12/2023 (preliminary)

Goals of the STSM

Purpose and summary of the STSM.

The overall goal of this STSM is a three-author collaboration between myself (Peter LeFanu Lumsdaine), Benedikt Ahrens, and Paige North, towards a paper in preparation, provisional title “Comparing notions of dependent algebraic theory”, continuing a project initiated at the WG6 kickoff meeting in Stockholm, May 2022.

This paper aims to survey various category-theoretic notions of dependent-algebraic theories existing in the literature, and systematically analyse their relationships. We hope thereby to clarify and systematise a currently rather disorganised area of the literature; a better understanding of the differences between these notions is a precondition for generalising them to a genuinely modular framework for fully-expressive dependent type theories, one of the primary objectives of Working Group 6 of the Action.

During this visit, we expect to complete the general research content of the planned paper, and make substantial progress on the paper’s writing. Ideally, we hope to complete a first draft of the paper.

Working Plan

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

As this is essentially an entirely theoretical project, we (Ahrens, North, and myself) will continue to collaborate in a traditional mathematical style. We propose to meet daily during the visit, working alternately on the not-yet-finished parts of the research content of the outlined paper, and on writing up the completed parts of the content.

Benedikt Ahrens is the proposed STSM host, and works in Delft. Paige North works in Utrecht, but will be able to meet in Delft daily through most of the planned visit.

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.

The expected output of the project is a research paper, for publication in a suitable journal in mathematic or theoretical CS, and a better understanding of an important topic to support further research going forward.

The topic falls directly within the scope of Working Group 6 on Type Theory: “...to develop a

comprehensive theory of type theories, which (i) accounts for its domain-specific variants and the type theories currently used in proof assistants, and (ii) allows for the modular reasoning about their syntax and semantics.” Specifically, it provides key progress towards the action’s Research coordination objective 7, “*Develop a modular theory of type theories.*”, and the corresponding deliverable “*Definition of a mathematical framework for modular reasoning about type theories and their extensions.*”

On the non-technical side, this proposal would clearly contribute to Capacity-building objectives 1, 2, 3, 5, 7, and 8 — most notably 5 (“*Actively support [...] the under-represented gender [...]*”) as one of the three collaborators is female (starkly under-represented in the field) and 8 (“*Disseminate the results of the Action activities to the scientific community [...]*”).