Philipp Jan Andries Stassen
Erik Sandbergs Gata 46
169 34 Solna, Sweden
+49 151 4242 9379
philipp.stassen@gmail.com

PhD student for Center for Basic Research in Program Verification

Dear Sir or Madam,

to thrive as a researcher in mathematical logic and computer science, I herewith apply as a PhD student in the Center for Basic Research in Program Verification. I am capable of conducting the relevant research in this area and am excited to develop new reasoning techniques in the field of type theory and category theory. Both my quick comprehension of complex topics as well as my passion for mathematical logic make me the most suitable candidate for a PhD under the supervision of Lars Birkedal.

My desire to focus on theoretical computer science and logic was sparked in May 2018, when I attended the summer school of the Hausdorff trimester program "Types Sets and Constructions". Studying at Stockholm university provided me with the perfect environment to focus more specifically on the constructive aspects of mathematical logic and theoretical computer science. I completed courses in Type Theory, Modal and Temporal Logic, Theory for Computation and Formal Language. Additionally, I attended the PhD-courses "Proof Theory and Subsystems of Second Order Arithmetic" and "Infinity-categories" during my masters studies.

I completed my master thesis together with my supervisors Peter LeFanu Lumsdaine and Guillaume Brunerie on the 30st of March 2020 with the title "An analysis of Curiens explicit syntax for Dependent Type Theory". We study a coherence problem that arises when interpreting dependent type theories in *locally cartesian closed categories* (as in [1]), which causes the interpretation to not be well-defined. Pierre-Louis Curien suggested in [2] to resolve said problem by designing an intermediate type theory which possesses an additional term constructor (the *explicit coercion*). For this syntax, the interpretation will turn out to be well defined. As also discussed in [3], relating the two syntaxes would give rise to a new understanding of categorial semantics. My thesis proves a strong equivalence theorem. Ultimately, this result functions as a tool to construct *weak models* for dependent type theories. The definitions and proofs are formalized in the proof assistant Agda[1].

For your future research I can benefit you through my deep insight in theoretical computer science and my vast experience in the field of type theory.

I am determined to acquire techniques and skills that are practically relevant inside and outside the field of mathematical logic – and make the results available for a broader audience. With my experience in and excitement for computer science, your PhD position provides me with the perfect opportunity to work interdisciplinary and to create practical applications for type theory.

Sincerely yours,

Philipp Stassen

encl: Curriculum vitae, Project description

[1] R. Seely. Locally cartesian closed categories and type theory. *Math. Proc. Camb. Phil. Soc. 95, 33-48*, 1984.

[2] P.L. Curien. Substitution up to isomorphism. *Fundamenta Informaticae 19*, pages 51–85, 1993.

[3] Chris Kapulkin Peter LeFanu Lumsdaine. The homotopy theory of type theories. *arxiv*, 2016.

[1] Please find the current status at https://github.com/philippstassen/initiality/tree/develop1