SCIENCES & BIOENGINEERING SCIENCES

The Research Group
Mathematics and Data Science

has the honor to invite you to the public defence of the PhD thesis of

Michiel Huttener

to obtain the degree of Doctor of Sciences

Joint PhD with UGent

Title of the PhD thesis:

Spaces of Smooth and Ultradifferentiable Vectors Associated with Lie Group Representations

Supervisors:
Prof. dr. Jasson Vindas Díaz (UGent)
Prof. dr. Andreas Debrouwere (VUB)

The defence will take place on

Thursday, June 12, 2025 at 5.30 p.m. in Auditorium A0, Building S9, Campus Sterre (UGent)

Members of the jury

Prof. dr. Bart De Bruyn (UGent, chair)
Prof. dr. Kenny De Commer (VUB)
Prof. dr. Hans Vernaeve (UGent)
Dr. Sigiswald Barbier (UGent)
Prof. dr. Céline Esser (ULiège)
Prof. dr. Bojan Prangoski (Ss. Cyril and Methodius University in Skopje, Macedonia)

Curriculum vitae

Michiel Huttener studied mathematics at UGent. Since October 2021, he has been a PhD student there with Prof. Dr. J. Vindas as his supervisor. The project evolved into a Joint PhD co-supervised by Prof. Dr. A. Debrouwere from VUB.

His research lies in the broad field of functional analysis with perspectives from various fields such as harmonic analysis, differential geometry and representation theory.

Besides doing research, he has also been involved in many aspects of the educational program for mathematics at UGent.

Abstract of the PhD research

Infinite dimensional representations of Lie groups can exhibit unexpected and undesirable behavior, even in the simplest examples. To overcome these problems, one can simply only consider objects belonging to the representation that do behave properly. These we call regular vectors.

The central objects of study in the thesis are those spaces of regular vectors associated with Lie group representations and their role in various problems from functional analysis. Not only fill these spaces an important theoretical need in the abstract theory of infinite-dimensional representations, but, as it turns out, many classical spaces from functional analysis can be viewed as spaces of regular vectors associated with some Lie group representation.

A first goal is to rigorously introduce the underlying foundations of these spaces of regular vectors. In particular, many classical definitions and results are generalized. For example, we consider smooth, real analytic, and ultradifferentiable vectors. We then use this framework to study two problems in analysis.

The first one concerns factorization problems, which are an important topic in harmonic analysis with a long tradition. Associated with any representation of a compact Lie group, there is a natural action of the convolution algebra of real analytic functions on the space of real analytic vectors. Among other results, we show that this space factorizes over this algebra. This solves a particular but important case of a recent conjecture about such factorization properties.

The second problem we consider is about two linear topological invariants in this context – namely, quasinormability and the property (Ω) – and more precisely, whether spaces of regular vectors inherit these invariants from the original representation space. Under very mild hypotheses, we show that the answer is positive. These lifting properties are then made concrete for weighted Fréchet function spaces that are invariant under the right regular action of their underlying Lie group.

The results of this thesis provide therefore a new powerful and systematic method to establish factorization properties, quasinormability, or the property (Ω), for large families of function spaces on the corresponding Lie groups.