Laudatio for Dr. Juan Aguilera, Recipient of the ÖMG Förderungspreis 2025

Dear Juan, dear colleagues,

It is my great pleasure to say a few congratulatory words on the occasion of the Förderungspreis 2025 of the Austrian Mathematical Society, awarded to Dr. Juan Aguilera, Technical University of Vienna. I also bring the best regards of Professor Matthias Baaz, one of Juan's doctoral supervisors, who unfortunately cannot be here today due to prior commitments.

Allow me to begin by outlining Juan's scientific path, before turning to some of his most significant mathematical achievements.

Juan Aguilera was born on April 27, 1993, and studied Applied Mathematics at ITAM, the Instituto Tecnológico Autónomo de México. It was there, under the supervision of David Fernández-Duque, that he first encountered mathematical logic, in particular proof theory. In his own recollection, Juan was immediately fascinated, and quickly convinced that this was the field in which he wished to pursue doctoral studies.

Following his advisor's recommendation, he contacted Professor Matthias Baaz in Vienna. In fact, already on the day after his Bachelor's thesis defense, he boarded a flight to Vienna. Professor Baaz recalls that, he requested the candidate to present an especially difficult and technical paper during the interview. Things, however, took an unexpected turn: he was deeply impressed by the student and hired him into one of his projects at the Faculty of Mathematics. It is worth mentioning that, already at that stage, Juan had achieved significant mathematical results. At the joint request of Professors Baaz and Goldstern, TU Wien exempted him from the usual requirement of a Master's degree before commencing doctoral studies.

In August 2015 Juan attended the Fifth European Set Theory Conference in Cambridge, where he met many of his future collaborators and, most significantly, began studying inner model theory under the supervision of Professor Hugh Woodin of Harvard University. In 2019 Juan completed his doctoral studies at TU Wien, with a thesis entitled *Between the Finite and the Infinite*, written under the joint supervision of Professors Baaz and Woodin.

By now, Dr. Aguilera has produced a remarkable body of work: more than sixty scientific papers, many of which published in leading journals such as *Inventiones Mathematicae*, *Transactions of the American Mathematical Society*, the *Israel Journal of Mathematics*, the *Journal of Mathematical Logic*, and many others. This is an impressive achievement, particularly at his scientific age.

Dr. Aguilera has made substantial contributions to mathematical logic and its many subfields, including proof theory, set theory, computability theory, reverse mathematics, and more. A particularly innovative aspect of his work is the way he combines techniques from these different areas to solve problems of deep interest in each of them separately.

Let me highlight three examples.

First, in his article *The Metamathematics of Separated Determinacy* (*Inventiones Mathematicae*, 2025), Dr. Aguilera uses methods from descriptive set theory and constructibility to study determinacy from the perspective of reverse mathematics. Determinacy axioms have profound structural consequences for the real numbers, such as implying Lebesgue measurability and the Baire property. In this work, he obtains a far-reaching generalization of Martin's Borel determinacy, yielding optimal strengthenings of the Harrington–Martin, Kechris–Woodin, and Neeman–Woodin determinacy transfer theorems.

Second, in joint work with Fedor Pakhomov on *Non-linearities in the Analytic Hierarchy*, Aguilera combines tools from inner model theory and ordinal analysis. Ordinal analysis, a branch of proof theory, aims at expressing consistency problems in terms of combinatorial assertions about linear orders. Their work produces a fascinating "non-linear" generalization of Gödel's Incompleteness Theorem. It is worth noting that proof theory and inner model theory are often regarded as opposite ends of logic—one concerned with the finite and the concrete, the other with the infinite and in a certain sense, the abstract. The interaction of ideas between them, as achieved here, had not been observed before.

Third, in his paper *Local Hanf–Tarski Numbers* (*Transactions of the AMS*, 2025), Aguilera characterizes large cardinals—weakly compact, measurable, strongly unfoldable—in terms of Hanf–Tarski numbers of extensions of first-order logic. A remarkable feature of the proofs is the use of elementary embeddings from transitive sets into ill-founded models of set theory.

These examples illustrate not only the technical depth of Juan's work, but also its breadth, and its capacity to open unexpected connections between areas often regarded as far apart.

Beyond his own research, Juan has also taken significant responsibility for the logic community. He was one of the lead organizers of this year's Logic Colloquium, the most important annual international conference in the field, which took place in Vienna. He organized, among other events, a thematic trimester on reverse mathematics at the Erwin Schrödinger Institute. He has been the scientific mentor of seven postdoctoral fellows and five doctoral students, and has successfully raised close to two million euros in third-party funding. Dr. Aguilera has already received several prizes and distinctions, including the START Prize of the Austrian Science Fund in 2024 and the E. W. Beth Dissertation Prize in 2020, awarded for the most outstanding doctoral dissertation in the fields of logic, language, information, and computation worldwide.

In conclusion, let me say that Dr. Aguilera has, already at an early career stage, established himself as one of the leading figures in contemporary mathematical logic. His work combines depth, originality, and breadth; his contributions to the community are equally significant. It is therefore my great pleasure to congratulate him on the Förderungspreis of the Austrian Mathematical Society, which is truly well deserved.