Prize Citations for the 2018 K-Theory Foundation Prizes

by the Prize Committee

July, 2018

Citation for Ben Antieau:

Antieau has contributed to a number of different areas within algebraic K-theory, including algebraic cycles, central simple and Azumaya algebras, derived categories of algebraic varieties, and K-theory of ring spectra. His work with Krashen, Williams and others on the period-index problem both in algebra and topology, and his work with Barthel, Gepner and Heller regarding K-theory of ring spectra stand out as profound contributions employing methods both classical and recent. Much of Antieau's work has focused on Azumaya algebras, the Brauer group and related topics, but he approaches this classical algebraic subject from a modern vantage-point.

Perhaps his most dramatic result, which is joint with Williams, concerns a counter example to a long-standing open question due to Auslander and Goldman. Specifically, they prove: There exists a smooth affine variety X of dimension 6 over the complex numbers and classes in the Brauer group of X such that the division algebra over the generic point has no Azumaya maximal order over X. The statement is purely algebraic, but the proof uses ideas from algebraic topology in a clever way.

In recent work with Barthel and Gepner, Antieau succeeds in formulating and proving strong localization results for algebraic K-theory of certain structured ring spectra. Importantly, their results apply to non-connective ring spectra, which typically arise as localizations of connective ones. Another very strong contribution to the study of algebraic K-theory of ring spectra appears in a joint work with Gepner and Heller. In particular, they obtain the first known calculations of the negative K-theory of non-connective ring spectra (as, for example, the complex K-theory spectrum or any other complex orientable cohomology theory), and demonstrate that the perfect derived category on a scheme X whose first negative K-group is nonzero cannot carry any bounded t-structure.

Citation for Marc Hoyois

The hugely impressive work of Hoyois is centered in motivic homotopy theory. He is a tremendously productive young researcher. In the few years since completing his PhD, he has made decisive contributions to a wide range of topics including:

1. A detailed proof of the Hopkins-Morel isomorphism relating Voevodsky's algebraic cobordism spectrum with motivic cohomology;

2. The motivic Steenrod algebra over fields of positive characteristic and essentially smooth schemes over fields;

3. A motivic version of the Grothendieck-Lefschetz trace formula;

4. $\mathbb{A}^1$-contractible smooth affine varieties;

5. A foundation of equivariant motivic homotopy theory with a full six-functor formalism;

6. In joint work with Bachmann, a good theory of multiplicative transfers (norms) in the motivic setting;

7. In joint work with Elmanto, Khan, Sosnilo and Yakerson, an elegant revision in the setting of infinity categories for the "infinite $\mathbb{P}^1$-loop-space recognition principle" recently developed by Garkusha, Panin, *et al.*

His research manifests a striking ability to combine abstract theoretical developments with concrete questions in algebraic geometry and homotopy theory — and also non-commutative geometry.

With Asok and Wendt he is pursuing a program of classification of vector bundles and other torsors on affine varieties via $\mathbb{A}^1$-homotopy theory, based on a useful criteria for $\mathbb{A}^1$-locality. With Scherotzke and Sibilla he has developed a formalism of higher traces refining the categorified character theory in derived algebraic geometry. Along the way they have also introduced a theory of relative noncommutative motives.