Ostrowski Prize 2009 for Sorin Popa

SORIN POPA of the University of California Los Angeles has received the 2009 Ostrowski Prize recognizing outstanding mathematical achievement in the field of operator algebras.

Popa received his Ph.D. degree in 1983 from the University of Bucharest. He has been professor at UCLA since 1988. He also held a professorship at the University of Geneva from 1996 to 1998. He has been an invited speaker at the 1990 International Congress of Mathematicians (ICM) in Kyoto and a plenary speaker at the 2006 ICM in Madrid. He was a Guggenheim Fellow from 1995 to 1996 and has been awarded the E. H. Moore Research Article Prize for 2010. He is an editor of the *Pacific Journal of Mathematics* and an associate editor of the *Journal of the American Mathematical Society* and the *Journal of Operator Theory.*

Sorin Popa works in operator algebras (von Neumann and C*-algebras) and orbit equivalence ergodic theory (also called measurable group theory). During the 30 years of his mathematical career he settled several difficult, fundamental problems in these areas. Thus, in the early 1980s, he answered three of the 20 problems posed by R.V. Kadison in his famous 1967 "List of Problems", notably an important characterization of the trivial relative commutant condition for II_1 subfactors involving maximal abelian subalgebras. In 1984 Popa gave a positive answer to the long standing factor state Stone-Weierstrass conjecture and in 1985 he solved the B.E. Johnson - S.K. Parrott problem, showing that all derivations of a II_1 factor into the ideal of compact operators is implemented by a compact operator. During 1985 - 2000, Popa proved several deep, fundamental results in Jones theory of subfactors with finite index. For instance, in a series of papers dealing with increasing levels of generality, he proved that hyperfinite subfactors with principal graph satisfying a certain amenability condition are completely classified by their standard invariant. Together with results of A. Ocneanu, M. Izumi, Y. Kawahigashi and P. Loi, this led to a complete listing of subfactors of Jones index less than or equal to 4, in both type II and III cases. In 1994 he gave an abstract characterization of the standard invariants of subfactors based on an important reconstruction theorem involving amalgamated free products of von Neumann algebras. Also, he introduced a "quantum double" construction for subfactors and used it to prove a surprising

hereditary property for hyperfinite subfactors with amenable graph, analogue to Connes' celebrated heredity of hyperfiniteness in II_1 factors.

During 2001 - 2004, Popa developed *deformation-rigidity theory*, a series of powerful techniques for studying rigidity phenomena in II_1 factors and orbit equivalence relations arising from measure preserving actions of groups on probability spaces. He used these techniques and results of D. Gaboriau on "cost" of group actions to prove that the natural action of SL(2,Z) on the 2-torus gives rise to a II_1 factor which is not isomorphic to the n by n matrices over it-self, for any integer n, and more generally for any positive real n (in the sense of Murray-von Neumann continuous dimension). This result solved another problem from Kadison's list. Also, he used deformation-rigidity to prove a striking version for group actions of Connes' rigidity conjecture showing that any isomorphism between II_1 factors arising from Bernoulli actions of groups with the property (T) of Kazhdan, comes from a conjugacy of the actions. In particular, two such factors can be isomorphic only if the corresponding groups are isomorphic. Moreover, Popa showed that a Bernoulli action of a property (T) group G is orbit equivalence superrigid i.e., if it has the same orbits as an arbitrary free measure preserving action of some group H, then $G=H$ and the two actions are conjugate. In an important subsequent development, he showed in 2006 that similar results hold true for non-amenable product groups as well. These breakthroughs had considerable impact, leading to many more surprising results in von Neumann algebras and ergodic theory. They also led to fruitful interactions with geometric group theory and found interesting applications to logic (countable Borel equivalence relations). According to the prize citation, Popa's new research direction "completely revolutionized the part of von Neumann algebra theory that is closely related to ergodic theory. His outstanding recent contributions undoubtedly deserve a major prize."