

STEVO TODORČEVIĆ AWARDED CRM – FIELDS – PIMS PRIZE

(Presented at the 5th Meeting, held on June 29, 2012)

The 2012 CRM-Fields-PIMS Prize, the highest Canadian award for research in mathematical sciences, has been awarded to Stevo Todorčević, a member of the Serbian Academy of Sciences and Arts.

The prize was established by three Canadian institutes: the Centre de Recherches Mathématiques (CRM), the Fields Institute, and the Pacific Institute for the Mathematical Sciences (PIMS). It is given annually for exceptional research in the mathematical sciences (including Statistics and Computer Science) and the winner is selected by an international committee nominated by the three institutes.

Stevo Todorčević has been named the winner of the 2012 CRM-Fields-PIMS Prize at the Winter Meeting of the Canadian Mathematical Society (Toronto, December 10–12, 2011) and the information appeared in the Notices of the American Mathematical Society, 59,4 (April, 2012) 578–579. The prize citation reads in part, “His contributions to set theory made him a world leader in this topic with a particular impact on combinatorial set theory and its connections with topology and analysis”.

Todorčević is known for solving important and long-standing mathematical problems. He solved the famous *S-space problem* that has been a subject of intensive research from the 1960's by showing that it is consistent that

every regular hereditarily separable space has the Lindelöf property. The dual *L-space problem* was solved recently by Justin Moore, a former student of Todorčević, who used the theory of oscillations of traces initiated by Todorčević. Together with Paul Larson Todorčević solved a sixty years old metrization *Problem of Katětov* by proving the consistency of the assertion “every compact space whose square is hereditarily normal is metrizable”. He also solved a Laver’s problem by showing that the quasi-ordering  $\leq_1$  on a class of trees is not a well quasi-ordering and a problem of Davis and Johnson from the early 1970’s about the existence of biorthogonal systems in Banach spaces.

He introduced several highly original and far reaching methods and techniques. So, investigating the generalizations of the Ramsey theorem in the category of uncountable structures and continuing the work of Sierpiński, Galvin and Shelah, Todorčević invented the *Method of Walks on Ordinals and Their Characteristics*, a powerful and widely used tool for building structures which are critical for such generalizations. This method was used by Argyros, López-Abad and Todorčević in the construction of a non-separable reflexive Banach space having no infinite unconditional basic sequence. In set theoretic forcing he introduced the *Technique of Models as Side Conditions* providing solutions of several problems in topology and set theory.

Stevo Todorčević is also known for isolating deep combinatorial principles. One of the principles is the *P-ideal dichotomy* saying that for each P-ideal  $\mathcal{I}$  of countable subsets of a set  $X$  either  $[A]^\omega \subset \mathcal{I}$ , for some uncountable subset  $A$  of  $X$ , or there is a partition  $X = \bigcup_{i \in \omega} X_i$  such that the intersection  $I \cap X_i$  is finite, for each  $I \in \mathcal{I}$  and each  $i \in \omega$ . Using this combinatorial principle (a consequence of the Proper Forcing Axiom and consistent with the Continuum Hypothesis) Todorčević obtained the optimal axiom-independent solution to the Maharam and von Neumann problem: he showed that a  $\sigma$ -algebra admits a strictly positive continuous submeasure if and only if it is weakly distributive and satisfies the  $\sigma$ -finite chain condition. One more significant application of this principle was made by Balcar, Jech and Pazák in solution of a problem of Maharam and von Neumann concerning fields of sets supporting strictly positive continuous outer measure. Another principle is the *Open-Graph Dichotomy* saying that any open edge graph on a separable metric space either has countable chromatic number or contains the complete graph on uncountably many vertices.

He also proved several remarkable theorems concerning the classification of mathematical structures. For example he was able to classify, up to a standard Tukey equivalence, all transitive relations on the class of all count-

able ordinals. Equally remarkable is Todorčević's classification of compact sets in the space of all Baire class 1 real-valued functions, endowed with the topology of pointwise convergence, where he identified three critical spaces in this class, the split interval  $S(I)$ , the Alexandrov duplicate of the unit interval  $I$  and the one point compactification  $A(I)$  of the unit interval equipped with its discrete topology.

In the review of the article *Fraïssé limits, Ramsey theory, and topological dynamics of automorphism groups*, written by Kechris, Pestov and Todorčević, Eli Glasner states “This remarkable paper is a tour de force where three experts in three disparate areas – model theory, structural Ramsey theory and topological dynamics – collaborate in creating a unified and beautiful theory”. This duality theory relates the properties of Ramsey classes of finite structures and dynamical properties of the automorphism groups of their Fraïssé limits. For example, one of the results of Todorčević and his collaborators is that a closed subgroup of the group of all permutations of the integers is extremely amenable (i.e. has the fixed point on compacta property) if and only if it is the automorphism group of the Fraïssé limit of a Fraïssé order class with the Ramsey property.

This theory inspired many mathematicians for further investigation and it is, perhaps, the best illustration of one of the basic intentions of Stevo Todorčević: to discover the Ramseyan phenomena in mathematical constructions.

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