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I. Main tasks of the research institute in 2010

The Alfréd Rényi Institute of Mathematics is an important centre of international mathematical life. In 2010 it maintained its rank and position at the forefront of the world's mathematical research.

The activity of the institute is carried out in nine scientific departments. With the support of the Academy's Momentum project, the Research Group in Cryptography established in 2009 continued its work within the Department of Discrete Mathematics. In 2010, the Research Group in Low Dimensional Topology started its work, also with the support of the Momentum project. Each department is in close connection with the other centers of its research subject. Due to this fact, they follow their research program on the most recent questions raised in the developments of mathematics.

In 2010 three research fellows of the institute were elected to be ordinary members of the Academy, another was elected to be a corresponding member, one researcher received the title "Doctor of Academy", and three completed their PhD. By the end of the year, 14 members of academy (12 according to time sheet statistics), 28 doctors of academy (24 stat.) and 31 PhD or candidate degree holders (30 stat.) worked in the institute. A particular stress was put on involving young talents – PhD students or young postdocs – in the research of the institute. In 2010, six additional such young researchers were employed filling the four new positions provided by the Academy as well as those that became vacant. The researchers of the institute supervised 14 PhD students in the joint Doctoral Program with Central European University. In 2010 altogether, counting the recently appointed young researchers, the institute had the opportunity to train 16 promising young talents.

In numbers comparable to recent years, the fellows of the institute published 167 works, 164 of which are scientific; the other three are popular scientific. The scientific works include five edited volumes, one thesis of academy doctor title, three PhD theses, seven book chapters, 30 publications in conference proceedings, one in Hungarian scientific journal and 117 publications in refereed international journals. Of these 117 papers, 109 appeared in foreign journals; the other 8 in English language international journals published in Hungary.

II. Outstanding research and other results in 2010

a) Outstanding research and other results

Department of Algebra

– Representation theory of the orthogonal group was applied to the problem of presenting the discriminant of real symmetric matrices as a sum of squares. In the case of three by three matrices it was proved that the minimal number of summands in a sum of squares representation is five, whereas in the case of four by four matrices the discriminant can be written as a sum of seven squares. For the general case of n by n matrices it was shown that there exists a representation as a sum of squares where the number of terms equals the dimension of the space of n-variable Laplace spherical harmonics of degree n.
– Finite p-groups that contain a single nontrivial characteristic subgroup were studied. This contributed to research started by Taunt in 1955. Among other things a complete characterization was given for all such groups that can be generated by at most four elements.
– A lower bound was proved for the size of sum sets in non-abelian groups, making use of a classical group theoretical result that had not been applied in this area before.
– It was shown that Ramanujan graphs have few short cycles. In particular, any sequence of d-regular Ramanujan graphs locally converges to the d-regular tree.
– The structure of invariant random subgroups was investigated. These are distributions on subgroups of a fixed group that are invariant under conjugation. It was shown that the fundamental spectral theorem for normal subgroups is satisfied for invariant random subgroups as well.
– It was shown that for any countable group, any free probability measure preserving action of the group weakly contains all Bernoulli actions of the group.
– The celebrated $k(GV)$ theorem, proved after 40 years, was strengthened. It estimates the number of conjugacy classes $k(GV)$.
– A single defining relation of the algebra of semi-invariants of three by three matrix triples was computed. Connections were pointed out between this problem and a couple of other prominent invariant theory situations.
– Restriction semigroups are biunary semigroups satisfying certain axioms. In some sense, restriction semigroups are non-regular generalizations of inverse semigroups. It was proved that every restriction semigroup has a proper cover which is embeddable (preserving both unary operations) into a W-product of a semilattice by a monoid.
– Several new results were obtained on Morita equivalence of semigroups with local units, extending a large part of this theory to factorizable semigroups. The most important of these results is a characterization of Morita equivalence in terms of Rees matrix covers.

Department of Algebraic Geometry and Differential Topology

– They contributed to the proof of the combinatorial nature of the Heegaard-Floer homology. The result implies that the computation of the Heegaard-Floer groups reduces to a combinatorial problem.
– They have studied the relation between various definitions of the Weil pairing on abelian varieties and its extension to 1-motives. Based on these results, they expect important applications in Iwasawa theory and a better understanding of dualities in the cohomology of Deligne 1-motives.

- They obtained substantial results in group theory and their representations. Given a finite simple group of Lie type, one starts with an arbitrary system of generators, and considers its small powers. They proved that the size of these powers grow exponentially as long as they reach the size of the group. This statement was known before for very special groups only. The result has already a number of applications: it is useful in certain number-theoretic sieve methods, and in the construction of expander graphs.
- It was an open question which surface singularities admit smoothings which have the rational homology of a disk. Such smoothings played a prominent role in the construction of many exotic smooth structures on closed 4-manifolds. The answer for the question was known for cyclic quotient singularities, and now it has been extended to weighted homogeneous singularities as well.
- They extended the Monodromy Conjecture of Denef and Loeser in dimension two, incorporating zeta functions with differential forms and targeting all monodromy eigenvalues, and also considering singular ambient spaces. That is, they treat in a conceptual unity the poles of the generalized topological zeta function and the monodromy eigenvalues associated with an analytic germ defined on a normal surface singularity. The Monodromy Conjecture is one of the most fruitful conjectures in singularity theory. The present work makes an important step in the understanding of the general picture.
- They proved that the boundary of the Milnor fiber of a complex non-isolated surface singularity is a plumbed 3-manifold. They determined an algorithm which provides this plumbing representation. Using this several singularity invariants can also be computed, like the characteristic polynomial of the monodromy.

Department of Algebraic Logic

- They gave a complete axiom system in first-order logic for the kinematics of special relativity theory without using the notion of photons, and consisting of three simple axioms (a tiny part of the relativity principle of physics, the continuity axiom schema for the field of real numbers, and existence of two observers observing each other's proper time as slower than theirs).
- They gave a similar photon-free axiom system for general relativity theory. They proved a strong logical completeness theorem for this, namely they proved that their axiom system is definitionally equivalent to a first-order logical axiom system of 3-smooth Lorentzian manifolds.
- As a natural continuation of a previous axiom system of theirs, they gave a first-order logic axiom system for general relativity theory which is complete with respect to the standard models (Lorentzian manifolds) of the theory. Furthermore, unlike in their previous axiom system, the notion of geodesics can be defined in such a way that it coincides with the usual notion of geodesics.
- They showed that the existence of closed timelike curves (time travel/causality violation) does not follow from the possibility of faster than light travel. This is contrary to popular belief.
- They showed that the operation of composition together with its right- and left-residuals and disjunction cannot be finitely axiomatized.

Department of Analysis

– A Markov inequality was proved for multivariable polynomials. *K*-monotone polynomials were investigated to get Bernstein-Chebisev inequality.
– For the new weighted generalization of the classical Kantorovich operators new convergence results were obtained.
– A new proof was obtained for the triangular type Fourier sums norm-estimation.
– For the Bernstein type operator a Grunwald-Marcinkiewicz type theorem was proved.
– Despite the unfortunate fact that the agreement with Bulgarian Academy of Sciences on approximation theory has no support for this year, they took part in the Sozopol conference on function theory using other means, and a survey paper was submitted on multidimensional generalizations of Bernstein's inequality on derivatives of polynomials.

Department of Discrete Mathematics

– They investigated the theory of large networks. They studied the regularities of giant graphs, like social or web networks. They constructed an optimal algorithm to find periodic subgraphs in sequences of giant graphs.
– Improving their earlier results, they proved several theorems about tree embeddings. The most important one is about embedding of trees with bounded degrees.
– They sharpened their earlier result concerning Toft's problem about color critical hypergraphs.
– A conjecture was established about the maximum size of hypergraphs not containing a particular trace. Several special cases of the conjecture were proved.
– They extended the extreme graph theoretical theorem of Erdős and Gallai on graphs to *r*-uniform hypergraphs.
– They estimated the size of sets of integers not containing any divisor of products of k elements. In this way, a classical result of Erdős about the case $k = 2$ was generalized.
– New theorems were proved about cycles through given vertices if the graph does not contain 4-stars and satisfies some connectivity conditions.
– They proved interesting results on a new search problem: when we are looking for an element of given property by means of non-adaptive search then n questions are needed in the worst case if several elements may have the property and the admissible question is if a subset contains an element having the property or not.
– The investigation of random polytopes was continued. They gave sharp estimates on the order of the variance and a central limit theorem was proved in some cases.
– Some convex geometry questions were answered by means of equivariant topology. They showed a theorem on homogenous plane selections.
– New cover theorems were proved in finite geometries.
– It is known that between the complex group algebras and the Ore extension of their von Neumann algebras there is a minimal regular *-algebra. By means of combinatorial tools from the theory of graph limits, they proved that this algebra is canonical and can be computed from the group if the group is amenable.
– They studied the relation of ergodic properties of pro-finite actions and graph expanders. They proved that a free group has continuum many weakly inequivalent ergodic free actions. They proved a super rigidity theorem on pro-finite actions too. They proved a conjecture of Lubotzky on expanders.
– They continued to establish extremal graph theory for geometric graphs.
– New Ramsey type results were proved, e.g., for monochromatic cycles.

- Interesting coloring type results were proved by means of topological methods.
- In cryptography, they proved results on pseudo random sequences, grids and other structures.
- They constructed efficient combinatorial algorithms used in biomathematics.
- They investigated the behavior of MCMC distribution generating algorithms and their applications in big structures.

Department of Geometry

- They gave a lower bound on the length of the shortest path connecting two points outside the members of a ball packing. It turned out that the detour one has to make in order to evade the balls is very small in high dimensions.
- The crossing number of a graph is the minimum number of crossings over all drawings. Its pair-crossing number is the minimum number of crossing pairs of edges over all drawings. They managed to improve the bound for the relationship between these two parameters, using a recent separator theorem for string graphs.
- The monotone crossing number of a graph is the minimum number of crossings over all drawings with x-monotone curves as edges. They found graphs whose monotone crossing number is greater than the ordinary crossing number. On the other hand, they showed that the monotone crossing number cannot be arbitrarily large if the ordinary crossing number is fixed.
- They further investigated generalizations of the Erdős-Szekeres theorem for point sets with some forbidden sub-configuration. In some cases they obtained better bounds.
- They dealt with characterizations of central symmetry of convex bodies. If, for a perturbation of the unit ball, among its intersections with any parallel hyper-planes, the maximal surface area is attained for the hyper-plane containing the origin, then the perturbation is, in first order, centrally symmetric. This research was the result of a visit with the support of the DFG.
- Two convex disks in the plane or on the sphere are said to cross each other if the removal of their intersection causes each disk to fall into disjoint components. Since the early seventies it was commonly believed that crossings in a plane covering by congruent convex disks, being counterproductive for producing low density, are always avoidable. They have found a shape and proved that the thinnest covering of the plane using copies of that shape always contains crossing pairs.
- They investigated the Chebyshev constants of the unit circle, and determined the L_2 Chebyshev constants. They considered the one-dimensional version of the problem of intersecting unit discs: the limit distribution and the expected length were obtained.
- The logarithmic mean of two origin symmetric convex bodies is the biggest origin symmetric convex body, whose support function is at most the geometric mean of the support functions of the two convex bodies. If the two convex bodies are symmetric through the coordinate hyper-planes, then they have proved that the volume of the logarithmic mean is at least the geometric mean of the volumes of the two convex bodies.
- They proved Gromov's conjecture, that there exist arbitrarily large $(d + 1)$-uniform hypergraphs with bounded degree such that their overlap numbers are bounded from below by a constant $c(d) > 0$.
- According to a well known theorem of Haussler and Welzl, any range space of bounded VC-dimension admits a small ε-net. It was shown that there exist geometrically defined range spaces of VC-dimension 2, for which the above bound can be attained.

Department of Set Theory and General Topology

- They extended some classical results on the chromatic numbers of almost disjoint set-systems to the conflict free chromatic numbers of such systems, by giving an essentially complete description of the latter.
- By significantly improving their earlier results on the resolvability properties of monotonically normal spaces (that include both metric and ordered spaces) they proved that all monotonically normal spaces are maximally resolvable exactly when all uniform ultrafilters are maximally decomposable. As an interesting consequence they obtained that the existence of a non-maximally resolvable monotonically normal space is equiconsistent with the existence of a measurable cardinal.
- They extensively studied the cardinal sequences of compact scattered spaces. They succeeded in giving a complete characterization of their potential values, at least in certain models of set theory.
- A basic question of functional analysis asks: which Banach spaces can be embedded into certain classical Banach spaces? It has recently turned out that to answer this one often needs set-theoretic methods and results. Using certain combinatorial principles they had introduced long ago in connection with the classical Cohen model, they proved some new non-embeddability results for Banach spaces.
- A clone over a set A is a family of (multivariable) functions on A that includes all projections and is closed under composition. The study of clones over finite sets is an established area of modern algebra, while much less known in the case of infinite sets. They have shown that over a countably infinite set there is a clone D with the property that for every natural number n there are the maximum number of clones all containing the same n-variable functions from D.
- They also produced valuable results belonging to the border area of geometric measure theory and set theory. In particular, they solved a question of Fremlin and one of Zapletal; proving some independence results concerning Hausdorff measures in both cases.

Department of Number Theory

- A formula was proved for the values of Hecke L-functions of real quadratic fields at 0 and negative integers. This formula expresses the values through the continued fraction representation of a generator of the field. Special cases have been previously used to solve the class number problem (conjectures of Yokoi and Chowla).
- An asymptotic formula was given for the second moment of Rankin-Selberg L-functions in certain Archimedean families. A special case treats the fourth moment of L-functions associated to holomorphic cusp forms.
- A new bound was found for the supremum of Hecke-Maass cusp forms in the level aspect. The result is as strong and natural as the Burgess bound for Dirichlet L-functions or twisted modular L-functions.
- Plünnecke's inequality on the cardinality of sum sets was extended to non-commutative groups.
- The norms on the set of integers that admit a Euclidean algorithm were described.

Department of Probability Theory and Statistics

- As a generalization of the so-called Albert-Barabási graphs, a new model was developed when the degree sequence forms a sufficient statistic. The existence and uniqueness of the maximum likelihood estimate was proved. For testing of goodness-of-fit the statistic defined in the regularity lemma was the most efficient.
- Researchers of the department studied the question, with what precision can one estimate the distribution of a stationary process from a finite sample, in the sense of Ornstein's *d*-bar distance. First time in the literature explicit results were obtained for a rather wide (nonparametric) class of processes.
- New results were obtained for multi-user models about secret key generation for certain coalitions of users.
- According to a classic theorem of George Pólya the two-dimensional random walk is recurrent with probability one. Interestingly, the property remains valid after removing all but one of the horizontal lines. The asymptotic properties of the original random walk were extended to the newly defined version, namely the strong invariance principle and the law of the iterated logarithm has been proved.
- Researchers of the department proved a "splitting" invariance property for a large class of weakly dependent stationary processes. They obtained several results for the structural and asymptotic properties of the so-called lacunary series.
- Some years ago an unexpectedly strong result was published on the tail probabilities of the maxima of a rich family of polynomials of Gaussian variables. With years of hard work it was demonstrated that although the original proof has several flaws, they can be corrected and thus the result is true.
- Researchers of the department proved stronger logarithmic Soboliev inequality on norms of bounded spin systems improving the results of Otto and Reznikoff.
- In 1985 Kipnis and Varadhan proved that in the multidimensional self-avoiding process two particles follow independent Brownian motion in contrast with their result of 1980 on the Harris-Spitzer type models. Accordingly, mixed Brownian processes were expected for processes with energy exchange. This was proved for the stochastic paradigm of the dynamic model of random walks with interactive particles.
- To measure the strength of stochastic relations of two random variables Pearson's correlation coefficient is appropriate in case of normal variables but it fails in cases important in applied statistics. A new and effective statistic was developed using only the inner distances of the two variables.
- A Fully Polynomial Randomized Approximation Scheme was given for the number of most parsimonious double cut and join paths. An energy function was given on such paths, for which all local minima are global ones, and these paths are exactly the Hannenhalli-Pevzner paths. Based on this result, a parallel MCMC method was implemented and it was tested on vertebrate genomes.

Applied research

The main research profile of the Rényi Institute is pure (theoretical) research and therefore most of the ongoing research projects do not have immediate applications. However, some research divisions, mostly related to the Discrete Mathematics Department and the Probability Theory & Statistics Department, having been active for years now, continued their research in the bioinformatics, database research, information theory and mathematical immunology research. Unfortunately due to the ever narrowing project funding possibilities, only the bioinformatics research group worked on a concrete research project.

The research group of about 10 researchers established in the framework of the cryptography project applied for and awarded by the "Momentum" program of the Hungarian Academy of Sciences continued its work in the following subjects: secret sharing protocols, anonymous broadcasting protocols and digital fingerprints. The most important breakthrough results were obtained in secret sharing. They have determined the complexity of secret sharing on trees (the first ever graph class for which this value is known) and obtained important results for the so-called Turán-type (multipartite) structures. They also introduced the notion of online secret sharing, in which case the dealer distributing the secret does not exactly know the structure. The notion is a useful basis for designing powerful cryptographic protocols.

Bioinformatics research at the institute continued with high intensity. The "Hungarian Bioinformatics" Transfer of Knowledge EU FP6 project of the institute came to the end in 2010, but until the end of September they had 11 further international researchers working in the institute each for a 2-4 months period. The topics remained genome rearrangement, insertion-deletion process (statistical alignment), phylogenetic (evolutionary) trees and networks and the quest for new statistical methods.

The institute is a member and one of the main research partner of a consortium led by German and Danish SME's which submitted in 2009 a research project proposal "Comparative Genomics and Next Generation Sequencing" for EU 7 "Research for the benefit of specific groups" call and was awarded the funding in 2010. The funding grant agreement was signed in 2010 and the research has begun. The Rényi Institute is a main development partner of several software packages of the project as well as of the "engine" of the software package.

Results were obtained, during the theoretical research of large (giant) graphs and networks, which were motivated by real world (e.g. sociology) questions which made possible the effective algorithmic (and practically useful) investigation of these large networks.

b) Relationship between science and society

The basic research themes of the institute are not ideal to become immediate subjects of dialogue between science and society. There were, however, some activities and events at the institute which attracted wider interest.

The members of the institute took a leading part in popularizing mathematics; they gave several public lectures, film screenings and meetings with university and high school students, among others, in the framework of the Festival of Hungarian Science. Similarly, they took an active part in nurturing new talents in mathematics by organizing several mathematical camps and other programs for elementary and secondary (high school) students. The success of these events is shown by the fact that most of the winners of the national mathematical competitions of Hungary were participants in 2010 or in previous years.

Related to the conference organized by the institute to honor the 70th birthday of its prominent member, Endre Szemerédi, numerous articles were published in the Hungarian and international press promoting (Hungarian) mathematics and praising Prof. Szemerédi. The exhibition *Math Art – Art in the World of Mathematicians* organized jointly with B55 contemporary gallery, exhibiting art works of mathematicians, friends and partners, was a similar success.

III. A presentation of national and international relations

National relations

The research fellows of the institute participated in the work of several universities (e.g. ELTE, BME, University of Debrecen, University of Szeged) as instructors, especially in giving courses for senior or PhD students of mathematics and physics. The joint mathematical PhD and MSc programs of Central European University and the institute began its eighth year. The department has 20 PhD students and 13 MSc students. The professors of the program (the faculty of the Mathematics Department) are mostly the fellows of the institute; they gave 17 courses last year. Counting the students at all universities, the researchers of the institute supervised 38 PhD students, 14 MSc and 9 BSc students and 2 scientific scholarship holders. The research fellows of the institute provide the majority of the professors for the Budapest Semesters in Mathematics program – organized mostly for American students. Forty-four fellows of the institute (61 percent of them) instructed in some Hungarian university. The number of classes they instructed was close to 5000 in 2010.

The weekly research seminars of the institute continued. The importance of the seminars exceeds the framework of the institute. They influence the trends in all of Hungarian mathematical research.

The fellows of the institute participate in the mathematical life well above the national average. They have important positions in the Mathematics Department of the Academy and its committees, the Council of the Research Institutes of the Academy, the Committee of Mathematics and Sciences, the committees of OTKA, and the Board of the János Bolyai Mathematical Society. The president of the János Bolyai Mathematical Society, the chairman of the Bolyai Research Fellowship Committee, the mathematics coordinator of the Board of

Young Researchers of HAS, the vice chairman of the Department of Mathematics of HAS, the chairman and the secretary of the Mathematics Committee of HAS, the chairman and vice-chairman of the Mathematics Doctoral Committee (HAS), the chairman of Committee of Biometrics and Biomathematics of HAS, the chairman of the External Advisory Board of the Institute of Computer Science an Automation of HAS, the chairman and vice-chairman of the CEU Mathematics Doctoral Program are all fellows of the institute.

International relations

Traditionally, the researchers of the institute have very wide-range international relations. The cooperation manifests mostly in joint publications, study trips in both directions, joint projects and jointly organized conferences. Thirty-nine fellows of the institute (counted with multiplicity) participated in the organization of international conferences and workshops in 2010, out of which 5 were organized – completely or partly – by the Rényi Institute. In general, this cooperation does not need institutional form, but their success is indicated by the large number of joint publications.

The scientific visits in the framework of the bilateral agreements of the Academy successfully helped scientific cooperation. They opened the possibility for successful joint research, useful exchange of information and sometimes for participation in conferences.

The fellows of the institute held 17 memberships in international scientific committees and 114 memberships in editorial boards of international journals. They gave 218 lectures at international conferences, many of which were invited or plenary talks. It should be mentioned that a member of the institute was an invited speaker at the International Congress of Mathematicians.

Fourteen members of the institute spent professional visits of more than 6 months of at the following institutions: Technische Universität Graz (Austria), École Polytechnique Fédérale de Lausanne (Switzerland), Universitat Politècnica de Catalunya – Barcelona Tech (Spain), Universitá di Roma "Tor Vergata" (Italy), Simon Fraser University (Canada), Auburn University (USA), University of Delaware (USA), University College of London (UK), University of Chicago (USA), Rutgers University (USA), City University of New York (USA), National Science Foundation (USA). The expenses were covered in all of the cases by the other party.

In 2010 the only remaining EU mobility project at the institute hosted 11 visiting scholars for a total of 23 months. One of the Momentum projects run at the institute employed another international (USA) fellow and it should also be mentioned that two of the young researchers of the institute are Americans too. At the same time, visitors came from non-European and European countries with the support from various sources like Fulbright scholarships, OTKA projects, bilateral agreements of the Academy and (in growing numbers) independent sources provided by the visitors. Altogether, the institute hosted close to 100 visitors in 2010, not counting conference participants.

The scientific meetings organized completely or partially by the institute were as follows.

– All-Class Reunion of Budapest Semesters in Mathematics, June 16-23, 2010
– 1st Emléktábla Workshop, July 26-29, 2010
– Ninth Summer School in Potential Theory, July 26-31, 2010
– Conference in honor of the 70th birthday of Endre Szemerédi, August 2-6, 2010
– The Mathematics of Vera Sós, September 10-12, 2010

Among the conferences organized by the institute the international conference to honor the 70th birthday of its member, Endre Szemerédi should be specifically mentioned, which attracted much higher professional and press interest than the usual conferences. It had about 250 participants and was supported (in addition to Hungarian sources) by the research centers DIMACS in the USA and the Czech DIMATIA, as well as by the Clay Mathematical Institute and the National Security Agency in the USA.

IV. Brief summary of national and international research proposals awarded in 2010

National grants

The research teams of the institute have been as successful as in previous years with Hungarian OTKA (Hungarian Scientific Research Fund) project proposals. However, the total income of the institute from these national projects was lower than in the previous two years because of the narrowing number of accepted projects and financial resources distributed by them. Still, it is safe to say that all faculty of the institute are members of at least one running OTKA project and that by far the institute submits the highest number of OTKA project proposals in mathematics. But the decrease of the total income of the institute from these sources seriously impacts the funding of research.

The trend of the previous years continued and both national and international project proposal calls for fundamental research projects have been further narrowed in 2010. The National Office for Research and Technology stopped accepting further applications in the middle of 2010 and even the project proposals (two NKTH-OTKA proposals – one of them consortional – and several "Mecenatúra" proposals from the institute) submitted for the calls of the first half year – some, like NKTH TECH09 even postponed from 2009 – have not been evaluated yet.

The projects for the "Momentum" call for special projects of the Hungarian Academy of Sciences are therefore very important and valuable to the institute. The joint funding of the cryptography project awarded in 2009 and the second Momentum project won in 2010 to study low dimensional topologies gave the majority of the institute's non-OTKA national grant funds (besides them, only some 5 million HUF grant income was awarded by mainly minor projects run in 2009 but post-financed by the National Office for Research and Technology only in 2010).

International grants

The majority of the mobility type EU FP6 so-called Transfer of Knowledge projects of the institute ended in 2009; the rest in 2010. There were several other individual FP7 mobility projects which enabled the institute to employ one international or returning Hungarian researcher, per project. The foreign researchers staying at the institute for a longer period successfully joined the ongoing research topics, opened new international research connections with their series of lectures and personal consultations. The major institutional mobility projects are not further funded by the European Union, so the future of these independent projects depends on the availability of individual applicants who wish to visit the institute. In 2010 there was no such applicant.

Recently new types of research projects of the European Research Council, namely Starting Independent Researcher and Advanced Investigators Grants, were introduced. These projects basically fund with several million Euros the research of small research groups run by the principal investigator (the starting independent researcher or the advanced investigator). There are a low number of funded projects and therefore these are highly competitive research calls. It is a great success for the institute that the PRIMEGAPS project, won in 2008, was followed by another successful Advanced Investigators Grant application – headed by a member of the institute and including several other members – in the 2010 round. The supported research will start in early 2011, after completing the research grant agreement, and therefore the funding will only be available from 2011.

The Rényi Institute is a member of a consortium led by German and Danish SME's which submitted in 2009 a research project proposal "Comparative Genomics and Next Generation Sequencing" for EU 7 "Research for the benefit of specific groups" call and was awarded the funding in 2010. The institute will do most of the software development for the project concerning new generation sequencing. The total funding of the project for two years will be around 600.000 Euros.

Altogether, due to the decreasing national project proposal possibilities the total research grant income of the institute in 2010 – as was foreseen – was more than 20% lower than the grant income in 2009. The support of OTKA projects was also somewhat lower, despite of the fact that the institute still wins the majority of all of the mathematics OTKA projects. The volume of the other national projects support increased slightly thanks to the two Momentum projects, but the support from the EU – due to the completion of the mobility projects – has dramatically decreased; by close to 40%. Therefore, the total project research grant income was the lowest in the past 4 years.

The current Momentum, OTKA and EU projects together with the two new EU projects awarded at the end of 2010 and basically started in 2011 will ensure that there will be no further decrease (or will even be some increase) in the total research grant income of the institute in 2011. The success of the research grant proposals for future years depends to a great extent on whether there will be new types of national or international project proposal calls.

The diagram below shows the receipts of the projects during the last 6 years.

Project supports 2005-2010 (in million HUF)
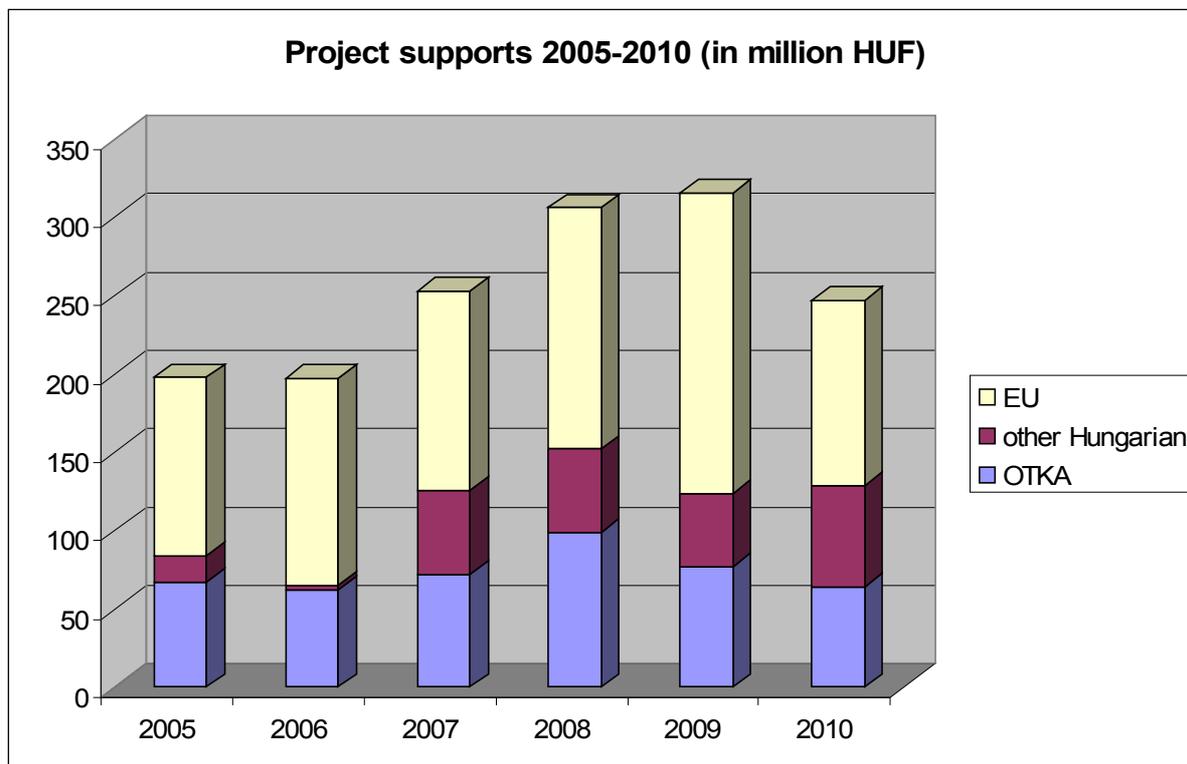
V. List of important publications in 2010

1.
PN Ánh, M Siddoway
Divisibility theory of semi-hereditary rings.
PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY 138:(12) pp. 4231-4242. (2010)

2.
I Bárány, P Blagojevic, A Szűcs
Equipartitioning by a convex 3-fan.
ADVANCES IN MATHEMATICS 223:(2) pp. 579-593. (2010)

3.
I Bárány, M Reitzner
Poisson polytopes.
ANNALS OF PROBABILITY 38:(4) pp. 1507-1531. (2010)

4.
I Csiszár, Z Talata
On rate of convergence of statistical estimation of stationary ergodic processes.
IEEE TRANSACTIONS ON INFORMATION THEORY 56:(8) pp. 3637-3641. (2010)

5.
G Elek
Parameter testing in bounded degree graphs of subexponential growth.
RANDOM STRUCTURES & ALGORITHMS 37:(2) pp. 248-270. (2010)

6.
M Elekes, T Keleti, A Máthé
Self-similar and self-affine sets: measure of the intersection of two copies.
ERGODIC THEORY AND DYNAMICAL SYSTEMS 30:(2) pp. 399-440. (2010)

7.
V Blomer, G Harcos
Twisted L-functions over number fields and Hilbert's eleventh problem.
GEOMETRIC AND FUNCTIONAL ANALYSIS 20:(1) pp. 1-52. (2010)

8.
P Major
Estimation of multiple random integrals and U-statistics.
MOSCOW MATHEMATICAL JOURNAL 10:(4) pp. 747-763. (2010)

9.
I Miklós, B Mélykúti, K Swenson
The metropolized partial importance sampling MCMC mixes slowly on minimum reversal rearrengement paths.
IEEE-ACM TRANSACTIONS ON COMPUTATIONAL BIOLOGY AND BIOINFORMATICS 4:(7) pp. 763-767. (2010)

10.
A Némethi, P Popescu-Pampu
On the Milnor fibres of cyclic quotient singularities.
PROCEEDINGS OF THE LONDON MATHEMATICAL SOCIETY 101:(2) pp. 554-588. (2010)

11.
DA Goldston, J Pintz, CY Yıldırım
Primes in tuples. II.
ACTA MATHEMATICA 204:(1) pp. 1-47. (2010)

12.
JL Smith, JE Barrett, L Rejtő, G Tusnády, SC Cary
Resolving environmental drivers of microbial community structure in Antarctic soils.
ANTARCTIC SCIENCE 22:(6) pp. 673-680. (2010)

13.
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