Pierre Deligne

2004 Balzan Prize for Mathematics

For major contributions to several important domains of mathematics (like algebraic geometry, algebraic and for analytic number theory, group theory, topology, Grothendieck theory of motives), enriching them with new and powerful tools and with magnificent results such as his spectacular proof of the Riemann hypothesis over finite fields (Weil conjectures).

Pierre Deligne Contest

Independent University Moscow

Adviser for the General Balzan Committee: Jacques Tits

The Pierre Deligne Contest is a competition for young mathematicians of Russia, Ukraine and Belarus. The contest winner is awarded a three-year research grant. The aim of the contest is to help young mathematicians to stay in their home countries to carry out scientific research.

Among the rules governing the contest, the following can be mentioned:

- Any person 35 or under who has a Ph.D. in mathematics and lives in Russia, Ukraine or Belarus is eligible for the competition.
- Competitors must provide a research statement, and grant recipients must present an annual report with a summary of the current year's achievements and their plans for the forthcoming year.
- All papers submitted by grant recipients during the grant period should mention partial funding from P. Deligne's 2004 Balzan Prize in Mathematics.

The Jury consists of two Co-Chairmen, two Vice-Chairmen, two scientific secretaries and numerous experts. The Jury members are: Pierre Deligne (Co-Chairman), Victor Vassiliev (Co-Chairman), Boris Feigin (Vice-Chairman), Yuliy Ilyashenko (Vice-Chairman), Mikhail Agranovich, Valeriy Beloshapka, Victor Buchstaber, Alexander Bulinskiy, Yurii Burman (scientific secretary), Alexey Gorodentsev, Sabir Gussein-Zade, Vadim Kaloshin, Alexander Khelemskiy, Askold Khovanski, Valeriy Kozlov, Sergey Lando, Segrey Matveev, Sergey Natanzon, Leonid Pastur, Alexander Razborov, Armen Sergeev, Alexander Shen (scientific secretary), Leonid Shilnikov, Albert Shiryaev, Iskander Taimanov, Dmitry Treshchev, Michail Tsfasman, Anatoly Vershik, Ernest Vinberg and Mikhail Zelikin.

Balzan funds were used to finance seventeen three-year research grants: five (5) in De-

cember 2005; five (5) in 2006; five (5) in 2007; and two (2) in 2008. Since the grants are for three years, those awarded in 2008 will continue until the end of 2011.
2005 Winners: Pavel Kolesnikov (Sobolev Institute of Mathematics, Novosibirsk), Alexander Kuznetsov (Steklov Mathematical Institute, Russian Academy of Sciences), Marat Rovinski (Independent University of Moscow), Sergei Shadrin (Moscow), and Arcady Skopenkov (Moscow State University).
2006 Winners: Mikhail Bondarko (St. Petersburg State University), Denis Borisov (Bashkir State Pedagogical University, Ufa), Sergey Loktev (Institute for Theoretical and Experimental Physics, Moscow), Taras Panov (Moscow State University), and Leonid Rybnikov (Institute for Theoretical and Experimental Physics, Moscow).
2007 Winners: Ivan Arzhantsev (Moscow State University), Leonid Positselski (Independent University of Moscow), Anton Savin (Independent University of Moscow), Evgenii Feigin (Independent University of Moscow), and Ilya Shkredov (Moscow State University).
2008 Winners: Evgenii Vdovin (Sobolev Institute of Mathematics, Novosibirsk), and Dmitry Chelkak (St. Petersburg).
Funds were used to finance 17 stipends. However, Sergei Shadrin left Russia to take up a position at the University of Zurich a few months after winning his grant in December 2005. Hence, according to the rules of the contest, he was no longer able to receive the grant. Taking into account future payments, the fund of 2004 expired. However, Pierre Deligne decided to prolong the contest for the year 2009.
2009 Winners: S.V. Oblezin (Moscow), and V.A. Timorin (Moscow).

Dedicated website: http://www.mccme.ru/pdc/rules_e.html.

Main publications:
Kolesnikov, P.
- *Identities of conformal algebras and pseudoalgebras*, Comm. Algebra 34 (2006), no. 6, 1965–1979.
- *On the Wedderburn principal theorem in conformal algebras*, J. Algebra and Its Appl., 6 (2007), no. 1, 119–134.
- *Associative algebras related to conformal algebras*, Applied Categorical Structures 16 (2008), no. 1-2, 167–181.
- *Universally defined representations of conformal Lie superalgebras*, Journal of Symbolic Computation 43 (2008), no. 6–7, 406–421.
- *On Irreducible subalgebras of matrix Weyl algebras*, in: *Advances in Algebra and Combinatorics*, K.P. Shum et al. (Eds.) World Scientific Publishing Co., Hong Kong,

2008. 205–217.
- *On irreducible algebras of conformal endomorphisms over a linear algebraic group*, Sovrem. Mat. Prilozh T60 (2008), 42–56.
- *Conformal Algebras in The Context of Linear Algebraic Groups*, in: *Generalized Lie Theory in Mathematics, Physics and Beyond*, S. Silvestrov et al. (Eds.), Springer, (2009), 235–246.

Kuznetsov, A.
- *Hyperplane sections and derived categories*, Izvestiya RAN: Ser. Mat. 70:3 (2006) p. 23–128 (in Russian); translation in Izvestiya: Mathematics 70:3 (2006) p. 447–547.
- *Homological projective duality*, Publ. Math. IHES, 105, n. 1 (2007), 157-220.
- *Quiver varieties and Hilbert schemes*, Moscow Mathematical Journal, Volume 7 (2007), N. 4.
- *Derived categories of quadric fibrations and intersections of quadrics*, Advances in Mathematics, V. 218 (2008), N. 5, 1340-1369.
- *Exceptional collections for Grassmannians of isotropic lines*, Proceedings of the London Mathematical Society, V. 97 (2008), N. 1, 155-182.
- *Lefschetz decompositions and categorical resolutions of singularities*, Selecta Mathematica, V. 13 (2008), N. 4, 661-696.
- *Derived categories and rationality of cubic fourfolds*, Proceedings 5-th European Congress of Mathematics.

Rovinsky, M.
- *Motives and admissible representations of automorphism groups of fields*, Math. Zeit., 249 (2005), no. 1, 163–221.
- *Semilinear representations of PGL*, Selecta Math., 11 (2005), 491–522.
- *Admissible semi-linear representations*, J. Reine Angew. Math. 604 (2007), 159–186.
- *Automorphism groups of fields, and their representations*, Russian Math. Surveys, 62:6 (2007), 1121–1186.
- *On maximal proper subgroups of field automorphism groups*. Selecta Math. 15 2 (2009), 343–376.

Skopenkov, A.
- *A new invariant and parametric connected sum of embeddings*, Fund. Math. 197 (2007), 253–269.
- *A characterization of submanifolds by a homogeneity condition*, Topol. Appl. 154 (2007) 1894–1897.

- *Classification of smooth embeddings of 3-manifolds in 6-space*, Math. Zeitschrift, 260:3, 2008, 647–672.
- *Embedding and knotting of manifolds in Euclidean spaces*, in: *Surveys in Contemporary Mathematics*, N. Young and Y. Choi (Ed.), London Math. Soc. Lect. Notes, 347 (2008) 248–342.
- Cencelj, M., Repovs, D. and Skopenkov, A., *Codimension two PL embeddings of spheres*
with nonstandard regular neighborhoods, Chinese Annals of Mathematics, Series B, 28:5
(2007) 603–608.

Bondarko, M.V.
- *Differential graded motives: weight complex, weight filtrations and spectral sequences for realizations; Voevodsky versus Hanamura*, J. Inst. Math. of Jussieu, 8 (2009), no. 1, 39–97.
- *Weight structures vs. t-structures; weight filtrations, spectral sequences, and complexes (for motives and in general)*, to appear in J. of K-theory.
- *Canonical representatives in strict isomorphism classes of formal groups*, Mathematical Notes, v. 82, n. 1–2, 2007, pp. 159–164.
- Bondarko M.V., Dievsky A.V., *Non-abelian associated orders of wildly ramified local field*
extensions, Zapiski Nauchnyh Seminarov POMI, vol. 356, 5–45, 2008.

Borisov, D.
- *On the spectrum of two quantum layers coupled by a window*, Journal of Physics A: Mathematical and Theoretical. 2007. V. 40. No. 19, 5045–5066.
- *Asymptotic behavior of the spectrum of a waveguide with distant perturbation*, Mathematical Physics, Analysis and Geometry. 2007. V. 10. No. 2, 155–196.
- *Distant perturbations of the Laplacian in a multi-dimensional space*, Annales Henri Poincare. 2007. V. 8. No. 7, 1371-1399.
- Borisov, D. and Cardone, G., *Homogenization of the planar waveguide with frequently alternating boundary conditions*, Journal of Physics A:Mathematics and General. 2009. V. 42. No. 36, 365205 (21pp).
- Borisov, D. and Freitas, P., *Asymptotics of Dirichlet eigenvalues and eigenfunctions of the Laplacian on thin domains in Rd*, Journal of Functional Analysis 258 3 (2010), 893–912.
- Borisov, D. and Freitas, P., *Eigenvalue asymptotics, inverse problems and a trace for-*

mula for the linear damped wave equation, Journal of Differential Equations. 2009. V. 247. No. 11, 3028-3039.
- Borisov, D. and Freitas, P., *Singular asymptotic expansions for Dirichlet eigenvalues and eigenfunctions on thin planar domains*, Annales de l'Institut Henri Poincare (C) Analyse non-lineaire. 2009. V. 26. No. 2, 547-560.
- Borisov, D. and Gagilishin, R., *Spectrum of periodic operators with a small local perturbation*. Izv. T.72, 4 (2008), 37–66.
- Borisov, D., *Asymptoties of solutions of ellipti systems with rapidly oscillating coefficients*, Alg. i An. 20 (2008), 19–42.
- Borisov, D. and Krejcirik, D., *PT-symmetric waveguide*, Integral Equations and Operator Theory. 2008. V. 62. No. 4., 489-515.

Rybnikov, L.
- Etingof, P., Loktev, S., Oblomkov, A., Rybnikov, L.,*A Lie-theoretic construction of spherical symplectic reflection algebras*, Transformation Groups, 13 (2008), no. 3, 541–556.
- Chervov, A, Falqui, G. and Rybnikov, L., *Limits of Gaudin Systems: Classical and Quantum Cases*. SIGMA 5 (2009).

Loktev, S.
- *Weight Multiplicity Polynomials of multi-variable Weyl Modules*, Moscow Math. J. 10 1 (2010), 215–229.
- Guay, N., Hernendez, D., Loktev, S., *Double affine Lie algebras and finite groups*, Pacific Math. J. 243 (2009), no. 1, 1–41.

Panov, T.
- *Cohomology of face rings, and torus actions*, in "Surveys in Contemporary Mathematics", London Math. Soc. Lecture Note Series, vol. 347, Cambridge, U.K., 2008, pp. 165–201.
- *Toric Kempf-Ness sets*. Proc. Steklov Inst. Math., vol. 263 (2008), p.159-172.
- Hiroshi Maeda, Mikiya Masuda and Taras Panov. *Torus graphs and simplicial posets*, Advances in Mathematics 212 (2007), no. 2, 458–483.
- Victor M. Buchstaber, Taras E. Panov and Nigel Ray, *Spaces of polytopes and cobordism of quasitoric manifolds*, Moscow Mathematical Journal 7 (2007), no. 2, 219–242.
- Mikiya Masuda and Taras Panov, *Semifree circle actions, Bott towers, and quasitoric Manifolds*, Mat. Sb. 199 (2008), no. 8, 95–122.
- Taras Panov and Nigel Ray, *Categorical aspects of toric topology*, in: *Toric Topology*

(M. Harada et al., eds.). Contemp. Math., vol. 460, Amer. Math. Soc., Providence, RI, 2008, pp. 293-322.

Arzhantsev, I. V.
- *On the factoriality of Cox rings*, Mat. Zametki 85 (2009), no. 5, 643-651.
- *Projective embeddings with a small boundary for homogeneous spaces*, Izv. Ross. Akad. Nauk Ser. Mat. 73 (2009), no. 3, 5–22.
- Arzhantsev, I., and Gaifullin, S., *Cox rings, semi groups and automorphisms of affine varieties*, Sbornik Math. 201, no. 1 (2010), 3–24.

Savin, A.
- Nazaikinskii, V. E., Savin, A. Yu., Sternin, B. Yu., *On the Poincaré isomorphism in K-theory on manifolds with boundaries*, (Russian) Sovrem. Mat. Fundam. Napravl. 34 (2009), 109-120.
- Nazaikinskii, V. E., Savin, A. Yu., Sternin, B. Yu., *The Atiyah-Bott index on stratified Manifolds*, (Russian) Sovrem. Mat. Fundam. Napravl. 34 (2009), 100-108.
- Savin, A. Yu, Sternin, B. Yu., *Surgery and index formulas on stratified manifolds*, (Russian), Dokl. Akad. Nauk 427 (2009), no. 3, 313–317.
- Savin, A. Yu., Sternin, B. Yu., *The index of nonlocal elliptic operators over Cá-algebras*, (Russian) Dokl. Akad. Nauk 426 (2009), no. 3, 314–317.
- Nazaikinskii, V. E., Savin, A. Yu, Sternin, B. Yu., *Noncommutative geometry and the classification of elliptic operators*, (Russian) Sovrem Mat. Fundam. Napravl. 29 (2008), 131–164.
- Nazaikinskii, E., Savin, A. Yu., and Sternin, B. Yu., *Elliptic theory and noncommutative geometry*, volume 183 of Operator Theory: Advances and Applications. Birkhäuser Verlag, Basel, 2008.
- Nazaikinskii, E., Savin, A., and Sternin, B. Yu., *On index of non local elliptic operators*, Dokl. 420 5 (2008).
- Nazaikinskii, E., Savin, A. Yu., and Sternin, B. Yu., *Non commutative geometry and classification of elliptic operators*. Sovr. mat. Fund. napr. 29 1 (2008), 131–169.
- Savin, A. Yu. and Sternin, B. Yu. *Non local elliptic operators on compact Lie groups*. Dokl. Nauk (2010).
- Nazaikinskii, E., Savin, A., and Sternin, B., *Atiyah-Bott index on stratified varieties*, Sovr. mat. Fund. napr. 34 (2009), p. 100–108.

Feigin, E.
- *N = 1 formal genus 0 gromov-Witten theories and Givental's formalism*, Journal of

Geometry and Physics 59 (2009), 1127–1136.
- Feigin, B., Feigin, E., Jimbo, M., Miwa, T. and Takeyama, Y., *A _1,3-Filtration of the Virasoro Minimal Series M (p, p′) with 1 < p′/p < 2*, Publ. Res. Inst. Math. Sci., Volume 44, Number 2 (2008), 213–257.
- Feigin, B., Feigin, E., Jimbo, M., Miwa, T., and Mukhin, E., *Fermionic formulas for eigenfunctions of the difference Toda Hamiltonian*, Letters in Mathematical Physics: Volume 88, Issue 1 (2009), 39–77.

Shkredov, I.
- *On sumsets of dissociated sets*. Online J. of Anal. Comb. 4 (2009), Art. 4, 26 pp.
- *Some applications of W. Rudins inequality to problems of combinatorial number theory*, Uniform Distribution Theory, 15 pages, submitted for publication (2009).
- *On an inverse theorem for U3(_)-norm*, Modern problems of mathematics and mechanics, Mathematics, Dynamical systems, v. 4, 2 (2009), 55–127.

Vdovin, E. P.
- *Carter subgroups of finite groups*, Siberian Adv. Math. v. 19 (2009), No. 1, 1–15.

Statements by the Prizewinner and by Professors Ilyashenko, Sossinsky, and Vershik:
Le règlement du prix Balzan stipule que pour moitié il doit être consacré à un ou plusieurs projets de recherche… qui devraient de préférence impliquer de jeunes chercheurs. Je suis heureux que ceci me permette d'essayer de repayer ma dette envers mes aînés en aidant de plus jeunes mathématiciens à suivre leur passion. Pierre Deligne (Rome, 18.11.2004)

A few words about the origin of the contest. In 2004 Pierre Deligne (Institute for Advanced Study, Princeton, NJ) was awarded the Balzan Prize. This prize is awarded by the Balzan Foundation for outstanding achievements in various domains of science and public service. Previously the Balzan Prize winners for mathematics were A. N. Kolmogorov, E. Bombieri, J.-P. Serre, A. Borel, M. Gromov and others. The rules of the Balzan Prize require that half of the sum would be spent for some project plausibly addressed to the support of young researchers. Pierre Deligne has chosen to support "struggling Russian mathematics". His proposal was accepted by the Balzan Foundation. (http://www.mccme.ru/pdc/rules_e.html)

In 2004 Deligne wrote in a letter to one of us: "I just won the Balzan Prize. Half the prize amount is for me to spend on a research project agreed to by the Balzan Foun-

dation. I believe that one of the most useful ways to spend this money (500,000 Swiss francs) would be for the benefit of the struggling Russian school of mathematics." Together with several collaborators of the Independent University of Moscow, Deligne implemented this idea by organizing the "Pierre Deligne Contest for Young Mathematicians", a yearly individual competition of research projects for young Russian, Ukrainian, and Byelorus mathematicians, whose laureates are granted a sizable three-year fellowship. Together with Victor Vassiliev, Deligne heads the jury of the contest, which is run along lines similar to those used by the American NSF. Since 2005 Deligne comes to Moscow each December to supervise the final deliberations. During the past four years, sixteen fellowships have been granted, and the money coming from the Balzan foundation (having in mind the future payments to recent winners) has been entirely exhausted, but Deligne intends to continue the contest by using his personal funds. In 2006 the Russian philanthropic foundation "Dynasty" has organized the "D. B. Zimin Dynasty Foundation Contest for Young Mathematicians" with the same jury and according to the same rules. According to the corresponding agreement, this contest will run for two more years, after which it may be continued. The continuation
of these two contests will undoubtedly play a crucial role in preserving the Russian mathematical school. We are deeply grateful to Pierre Deligne for his noble initiative, which has already done a great deal to help young Russian mathematicians to survive without giving up research. Yu. Ilyashenko, Moscow Independent University, Steklov Math. Institute; A. Sossinsky, Moscow Independent University, Institute of Mechanics; A. Vershik, St. Petersburg Branch of Steklov Math. Institute ("Notices of the American Mathematical Society", Volume 56, number 10, November 2009, p. 1232).

I am particularly happy that this program has encouraged the russian foundation "Dynasty" to create similar grants (three in December 2006, 2007, 2008 and 2009, and eight starting from December 2010). The same jury, recruited by Moscow Independent University, and of which I was co-president, gave both series of grants. Pierre Deligne (2010)