Report on the 2016 Morningside Medals

by Jing Yu*

Morningside Medal of Mathematics was established since 1998, which recognizes exceptional mathematicians of Chinese descent under the age of 45 for their seminal achievements in pure and applied mathematics.

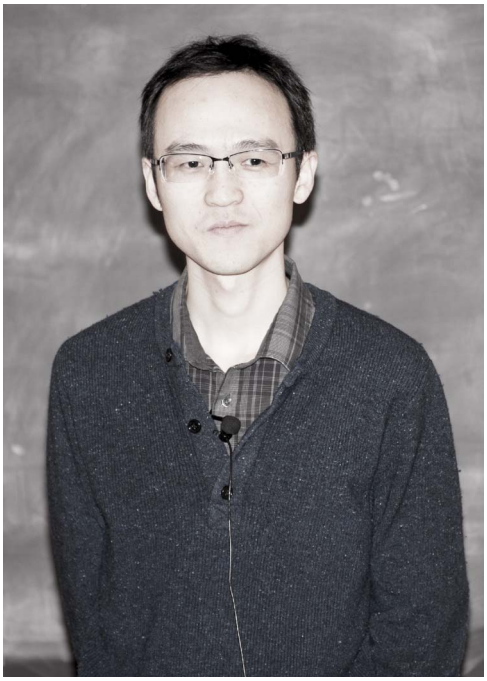
The Morningside Medal Selection Committee chaired by Professor Shing-Tung Yau comprises a panel of world renowned mathematicians. The selection committee, with the exception of the committee chair, are all non-Chinerse. There is also a nomination committee of about 50 mathematicians from around the world nominating the potential candidates. In 2016, there are two recipients of Morningside Gold Medal of Mathematics: Wei Zhang (Columbia University), Si Li (Tsinghua University), one recipient of Morningside Gold Medal of AppliedMathematics: Wotao Yin (UCLA), and six recipients of the Morningside Silver Medal of Mathematics: Bing-Long Chen (Sun Yat-sen University), Kai-Wen Lan (University of Minnesota), Ronald Lok Ming Lui (Chinese University of Hong Kong). Jun Yin (University of Wisconsin at Madson), Lexing Yin (Stanford University), Zhiwei Yun (Yale University).

The 2016 Morningside Medal Selection Committee members are: Demetrios Christodoulou (ETH Zürich), John H. Coates (University of Cambridge), Simon K. Donaldson (Imperial College, London), Gerd Faltings (Max Planck Institute for Mathematics), Davis Gieseker (UCLA), Camillo De Lellis (University of Zürich), Stanley J. Osher (UCLA), Geoge C. Papanicolaou (Stanford University), Wilfried Schmid (Harvard University), Richard M. Schoen (Stanford University), Thomas Spencer (Institute for Advanced Studies), Shing-Tung Yau (Harvard University).

* Department of Mathematics, National Taiwan University
E-mail: yu@math.ntu.edu.tw

2016 Morningside Gold Medal of Mathematics

Wei Zhang



A Morningside Gold Medal of Mathematics is awarded to Wei Zhang at the 7-th ICCM in Beijing, August 2016.

Citation The past half century has witnessed an extensive study of the relations between L-functions, automorphic forms, and algebraic varieties with a web of conjectures and predictions under the framework of Langlands program and arithmetic geometry.

The work of Wei Zhang has represented both decisive progress in some of these conjectures and new discovering of several unexpected phenomena. His work opens up a new era in the arithmetic of automorphic forms on higher rank groups and special values/derivatives of L-functions. We briefly describe four of Wei Zhang's path-breaking contributions as follows.

The first major piece of Wei Zhang's work is his proof of Kudla's conjecture on the modularity of cycle-valued theta series. Here the cycles arise from special subvarieties of an arbitrary dimensional orthogonal Shimura varieties. The case of codimension one cycles is already a major theorem of R. Borcherds proved by using regularized theta integrals. The case of high codimension was thought to be unapproachable. Wei Zhang's approach to circumvent this difficulty for arbitrary codimension was thus a surprise to experts in this area. He proved Kudla's conjectured when he was just a second year Ph.D. student at Columbia University under the supervision of Shou-Wu Zhang. The work of Wei Zhang is one of main ingredients in his joint work with Xinyi Yuan and Shou-Wu Zhang which establishes a general Gross–Zagier formula relating the central derivative of Rankin–Selberg L-functions to the Neron–Tate height of Heegner points. Such a formula is a culmination of earlier work of Shou-Wu Zhang in the search of a conceptual extension of the landmark work of Gross–Zagier.

The second major piece of Wei Zhang's work has been centered on the theory of relative trace formula with the goal to study the the central values or derivatives of L-functions, in terms of the automorphic periods or algebraic cycles on Shimura varieties. For the central L-values, such relations are formulated as the Gan–Gross–Prasad (GGP) conjecture and have been refined by Ikeda–Ichino. In a tour de force work, Wei Zhang made a breakthrough to the GGP and its refinement for higher rank unitary groupsrelating relating central L-values to automorphic periods. For the central derivatives, Wei Zhang has initiated a program to attack the arithmetic GGP conjecture relating central derivatives of L-functions to heights of algebraic cycles on Shimura varieties. Major steps of the program have been set up, notably the arithmetic fundamental lemma by himself and the arithmetic transfer conjecture in collaboration with Michael Rapoport and Brian Smithling.

The third major piece of Wei Zhang's work is his proof of the Kolyvagin conjecture which is apparently a completely different direction than those described above. This is a conjecture on the p-indivisibility of Kolyvagin system arising from Heegner points on an elliptic curve over an imaginary quadratic field for good ordinary primes p. The approach of Wei Zhang involves an ingenious induction argument on the rank of the underlying p-Selmer group where the base case follows from the known results on Iwasawa main conjectures. The underlying suggestive principle is "level raising and rank lowering". The proof of Kolyvagin conjecture leads to some significant results towards the Birch–Swinnerton-Dyer (BSD) conjecture for elliptic curves over the rationals. In particular, Wei Zhang proved a converse of Gross–Zagier and Kolyvagin's theorem: if the p-Selmer rank of an elliptic curve over the rationals equals one then so is the order of vanishing of the corresponding L-function. It was soon followed by a joint work with Manjul Bhargava and Chris Skinner to prove that a majority of the elliptic curves over the rationals satisfy the BSD conjecture.

The final piece of his major work is his recent joint work with Zhiwei Yun. They have stunned the community with a formula relating arbitrary order central derivatives of L-functions to some algebraic cycles on moduli spaces of Drinfeld Shtukas in the function field case. The possibility of a higher rank analogue of the Gross–Zagier formula was a huge surprise to the experts. It is in fact the first result concerning arithmetic interpretation of higher order derivatives of L-functions and gives a glimpse of an unexpected facet of L-functions.

Response on receiving the gold award It is a great honor to receive one of the Morningside medals in mathematics at ICCM in Beijing, a place that is unique to me in many ways: not only because I went to study in Peking university in my early stage of pursuit of mathematician as a profession, but also because in the past ten years I frequently visited Beijing, especially Morningside center and Chinese academy of science, a place for the inception of much of my mathematical work. Not to mention that Beijing is evolving fast as one of world-wide centers in mathematics; I look forward to the opportunity offered by ICCM organizers to meet colleagues in the conference. I would like to take the opportunity to thank many teachers in various stages of my career. In addition to obviously my advisor Shouwu Zhang, these include Dorian Goldfeld, Benedict Gross, Herve Jacquet, and Michael Rapoport. Thanks also go to my co-authors from them I am constantly inspired.

Biographical sketch Wei Zhang is currently a professor of mathematics at Columbia university. His research focuses on the area of number theory and automorphic forms. He is the recipient of the 2010 SASTRA Ramanujan Prize, and a Sloan Research Fellowship in 2013. He received a B.S. degree in Mathematics in 2004 at Peking university, and a Ph.D. in Mathematics in 2009 at Columbia University. He taught at Harvard university before joining the faculty of Columbia university in 2011.

Si Li

Professor Si Li is awarded the 2016 Morningside Gold Medal of Mathematics in August 2016, at the 7-th ICCM in Beijing.

Citation Si Li has been awarded the Morningside Gold Medal for his many deep and important contributions to areas of mathematics related to string theory. Much of Li's work concerns mirror symmetry. Mirror symmetry has its origins in string theory, as a conjectural equivalence between two different two-dimensional topological field theories built from a Calabi–Yau manifold. The topological field theories are called the A-model and the B-model. The A-model is well-formulated and extensively studied in mathematics: it is described by the theory of Gromov–Witten invariants.

The B-model is much more mysterious. Physicists Bershadsky, Cecotti, Ooguri and Vafa gave a non-rigorous definition of the B-model in terms of a certain quantum field theory in 6 dimensions. This field theory is non-renormalizable and hence ill-defined even by physicists standards.

The problem of making the B-model rigorous beyond its classical limit has been a major stumbling block to making progress in mirror symmetry. Li's work on the B-model has for the first time overcome this fundamental difficulty. With Costello, he provided a rigorous construction of the quantum field theory described by Bershadsky et al. on a variety of Calabi–Yau manifolds. Further, in a tour de force paper, Li explicitly solved this quantum field theory in the case when the Calabi–Yau manifold is an elliptic curve. He found that his solution of the B-model matches exactly the solution of the A-model on the mirror elliptic curve found by Okounkov and Pandharipande. Li's paper provides the first, and so far the only, example in which mirror symmetry has been proven at all genus on a compact Calabi–Yau manifold.

A variant of the theory of mirror symmetry arises in the study of singularities associated to quasi-homogeneous polynomials. In this setting, one has two topological field theories associated to the polynomial, called the Landau–Ginzburg A- and B-models. The Landau–Ginzburg A-model was defined by Fan–Jarvis–Ruan. At the classical level, the Landau–Ginzburg B-model was constructed in the 1980s by Kyoji Saito, using sophisticated algebro-geometric techniques.

There had long been a fundamental obstruction to proving mirror symmetry for Landau–Ginzburg models. Even though the Landau–Ginzburg B-model had been constructed in the 1980s, it was very difficult to compute anything in this theory because the construction relied on very abstract algebro-geometric techniques. From 1983 to 2013 only a handful examples were computed (ADE singularities and simple elliptic singularities).

In a remarkable series of papers, S. Li, with his collaborators C. Li, K. Saito and Y. Shen, solved all these problems. They developed the Landau–Ginzburg version of the quantum field theory of Bershadsky et al. (at the classical level) to provide a new approach to the Landau–Ginzburg B-model. They showed that their new theory is both explicitly computable and equivalent to the existing theory of K. Saito. This allows them to compute exactly the Landau–Ginzburg B-model for basically any singularity.

As an example of the possibilities this new technique has opened up, Li and his collaborators prove mirror symmetry at all genera for Arnold's 14 exceptional unimodular singularities. This vastly generalizes the number of cases where mirror symmetry can be proved at all genus, and makes it clear that their technique will apply in great generality.

These examples make clear Li's many deep and creative contributions to the mathematics surrounding string theory.

Response to Morningside Gold Award I am deeply grateful to the International Congress of Chinese Mathematicians and the Selection committee for choosing me as the corecipent of 2016 Morningside Gold Award. It has been a great opportunity for me to think and work on the interplaying platform between geometry and physics. I started my professional mathematical training at Harvard where I had a chance to learn furthermore many fascinating aspects of physics, especially quantum field theory and string theory. I would like to express my sincere thanks to Mr. Sze-Lim Li who had financially supported my first year life in the united states. At that time, the great influence and encouragement from

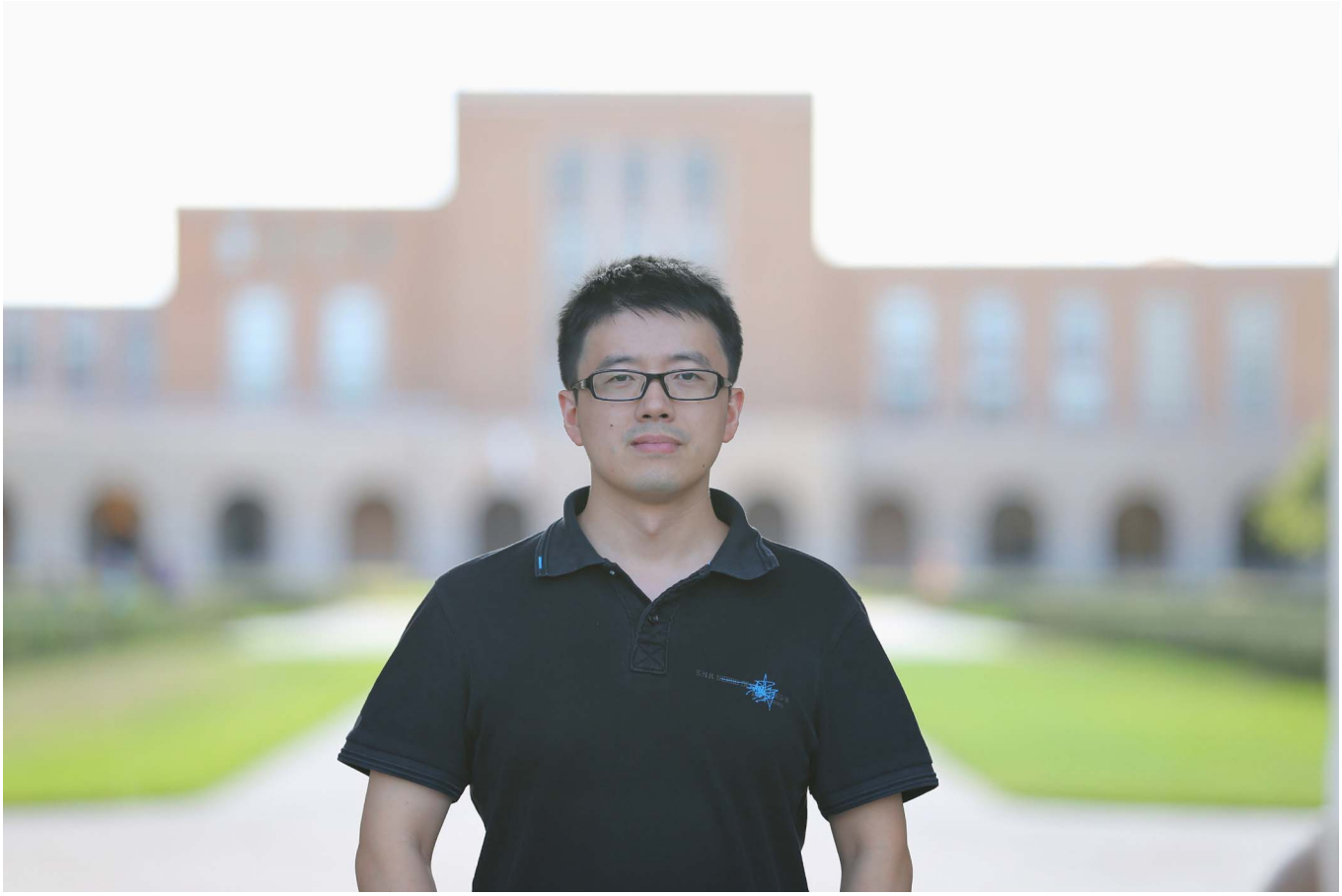
Shing-Tung Yau and Cumrun Vafa formulated my later journey on exploring the use of renormalization theory of quantum fields to study quantization problems in geometry. My professional career started at Northwestern University, where I met Kevin Costello that I would like to pay special thanks to. Our fruitful collaboration over the past years on developing the quantum theory of Calabi–Yau moduli spaces has inspired and reformulated many aspects of my views and thoughts on mathematical physics. During my professional career, I also benefited a lot from discussions with Kyoji Saito and Yongbin Ruan. They introduced to me both the classical and the modern viewpoints on singularity theory that eventually leads to my general solution to the Landau–Ginzburg mirror symmetry conjecture. I am deeply indebted to my parents and my wife for their selfless love and enormous support. They allow me to devote my time to my works. I also thank my son and my daughter, whose birth and growth have changed many faces of my philosophy in life and sciences. In 2014, I joined the Yau Mathematical Sciences Center at Tsinghua University. I greatly appreciated the freedom, the active events, and the stimulating culture that the institution has been providing.

Biographical sketch Si Li joined Tsinghua University in 2014, and is now Professor at the Yau Mathematical Sciences Center and Department of Mathematica Sciences. He received his B.S. and M.S. degrees from the University of Science and Technology of China, and his Ph.D. in Mathematics from Harvard University. Thereafter he did his postdoctoral research at Northwestern University. Professor Li's research focuses on geometry and mathematical physics. He introduced the renormalization method of gauge theory into the study of complex geometry and Hodge theory on Calabi–Yau manifolds, which are central geometric objects in string theory. He developed a quantum theory of Calabi–Yau moduli space and established the mathematical foundation of quantum topological B-model and higher genus mirror symmetry on compact Calabi–Yau manifolds.

2016 Morningside Gold Medal: Applied Mathematics

Wotao Yin

Citation Wotao Yin is awarded the Morningside Gold Medal of Applied Mathematics for his groundbreak-



Professor Wotau Yin is awarded the 2016 Morningside Gold Medal of Applied Mathematics in August 2016, at the 7-th ICCM in Beijing.

ing work on sparse optimization, ill-posed inverse problems, and compressed sensing. Professor Yin's work focuses on computational optimization and its applications in image processing, machine learning, and other inverse problems. He co-developed several optimization methods and algorithms, such as FPC, Bregman methods, FTVd, and RecPF, that are widely used in data sciences and engineering. His recent work has been large-scale, parallel, and distributed computing, including the ARock framework for asynchronous optimization and the EXTRA algorithm for fast decentralized optimization. He and his student made a breakthrough in monotone operator splitting, the methodology of reducing complicated problems into simple subproblems. They introduced the first three-operator splitting scheme, which not only generalizes the major existing schemes but also extends operator splitting to new applications.

Response from Wotao Yin I am deeply honored to receive the 2016 Morningside Medal. As an applied mathematician and operations researcher, I develop mathematical methods to solve problems in science, engineering, and business, so I enjoy seeing my results recognized for being useful. I also appreciate the citation from the ICCM. But I never dreamed of winning this award because I know how brilliant the previous Morningside medalists are. My primary research area is optimization, which traditionally solves problems arising in operations research and engineering. In the past decade, the demand to solve large optimization problems in information and data sciences quickly grew, providing me (and many others) a great stomping ground with many challenges. Therefore, I want to thank the pioneers of information and data sciences for their groundbreaking work and the opportunities they created for new research.

I wish to thank those at Nanjing University and Columbia University for introducing me to mathematics and computation. My Ph.D. advisor Donald Goldfarb gave me the best training and lots of inspiration. My colleague and collaborator, Stanley Osher, took my research to unanticipated new directions more than once, and my life changed due to my visit with Donald to Stanley and IPAM back in 2003. The collaborations with Richard Baraniuk, Terrence Chen, Ming-Jun Lai, Qing Ling, Zaiwen Wen, Yin Zhang, and others enriched me tremendously. I must have learned more from my excellent students than they from me. Many thanks to my other colleagues at Rice and UCLA for the enjoyable atmospheres and great times.

Bibliographical Sketch of Wotao Yin Professor Wotao Yin received his B.S. in Mathematics and Applied Mathematics from Nanjing University, and his M.S. and Ph.D. in Operations Research from Columbia University. He is a recipient of the National Science Foundation CAREER Award (2008) and the Sloan Research Fellowship (2009). Currently he is Professor of Mathematics at the University of California. Los Angeles. Between 2006 and 2013, he was Assistant Professor and later Associate Professor at Rice University.

2016 Morningside Silver Medals of Mathematics

Bing-Long Chen

Professor Chen is awarded a Morningside Silver Medal of Mathematics in August 2016, at the 7-th ICCM in Beijing.

Citation Bing-Long Chen is awarded silver medal for his significant contributions to Ricci flow and its applications. In particular, Chen is cited for the following papers:

1. (with Zhu, X.-P.) "Uniqueness of the Ricci flow on complete noncompact manifolds", J. Diff. Geom., 74(2006), 119–154. "Strong uniqueness of the Ricci flow", J. Diff. Geom., 82(2009), 363–382.
   The existence and uniqueness of the solutions are fundamental problems for a partial differential equation, like Ricci flow. The short-time existence and uniqueness of the Ricci flow on compact manifolds were established by the founder of the Ricci flow R. Hamilton in 1982, and the short-time existence was generalized to non-compact manifolds with bounded curvature in the late 1980s by W. X. Shi. For the uniqueness of the Ricci flow of bounded curvatures on non-compact manifolds, even partial results under very restrictive conditions were rare before the problem was completely solved by Chen (together with Zhu, X. P.) in 2006 in the first paper. For example, in his famous work in 2003, G. Perelman gained the uniqueness of essentially rotationally symmetric solutions on 3-dimensional Euclidean space.
   One should note that the bounded curvature condition is an analogue to the exponential growth

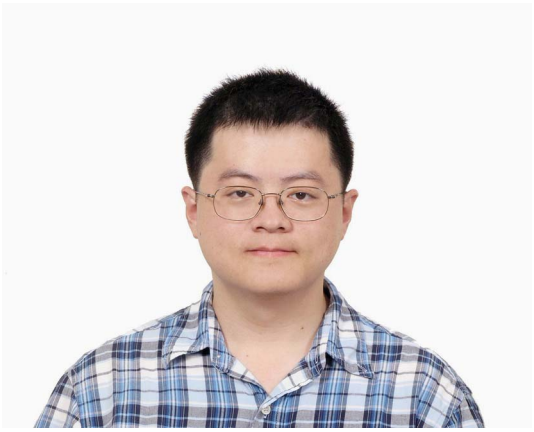
on the solution to the linear heat equation on the real line. If we don't assume certain growth control on the solutions, the uniqueness does not hold even for the linear heat equation on the real line. In the second paper, Chen discovered a peculiar phenomenon for 3-dimensional Ricci flow, proved the so called strong uniqueness theorem. An interesting corollary of his result is that if we launch the Ricci flow from the Euclidean metric on 3-dimensional Euclidean space, then the solution remains Euclidean for all time if assumed to be complete.

2. (with Tang, S.-H. and Zhu, X.-P.) "Complete classification of compact four-manifolds with positive isotropic curvature", J. Diff. Geom., 91(2012), 41–80.
   In this paper, Chen (together with Tang, S.-H and Zhu, X.-P.) developed a surgery theory of the Ricci flow on orbifolds, which shows that in many essential cases the orbifold singularities must be inevitably introduced by the surgery procedure. Using this method, Chen, Tang and Zhu gave a complete classification of all compact 4-dimensional manifolds that admit a metric with positive isotropic curvature. In particular, this implies that the fundamental group of the manifold contains a free subgroup of finite index, which confirms a conjecture of Gromov proposed in 1993 in 4-dimension. Their result also gave a complete topological classification of all compact conformally flat four-manifolds with positive scalar curvature.

Response from Bing-Long Chen I sincerely appreciate the decision of the International Congress of Chinese Mathematicians and the Selection Committee on choosing me as the corecipent of the Morningside Silver Award of 2016. I will take this opportunity to express my heartfelt gratitude to those who have had great influences on my career and life. I am indebted to my teachers Professor Xi-Ping Zhu and Professor Shing-Tung Yau for introducing me to the beautiful field of mathematics-Ricci flow. My first year of Mathematical Analysis (Calculus) course was taught by Professor Zhu when I began my undergraduate studies in Sun Yat-sen university in 1992. Several years later I was also fortunate that I could follow him to learn Ricci flow, this actually started a long term collaborations from which I benefited a lot since that time. Professor Shing-Tung Yau, the prominent leader of the field, constantly urged us to study the Ricci flow, his guidances were the great support to us. As is well-known, Ricci flow was founded by R. Hamilton in 1982, with an aim for solving the great key problems in geometry and topology, like Poincare conjecture, etc. I think we should pay hanks to R. Hamilton for creating such an elegant field of mathematics. I also would like to thank my parents and my family, their permanent love is my strongest backing. When I occasionally stayed with my daughter of six years old on finishing her mathematical homework, I always felt deep gratitude to all the teachers, friends and relatives who have taught me and help me grow up.

Biographical sketch Bing-Long Chen was born in Shanxi, China. He received his Ph.D. in Pure Mathematics in 2000 from Sun Yat-sen University and became a professor in Sun Yat-sen University in 2004. He was awarded the National Science Fund for Distinguished Young Scholars in 2010 and was named a Chang Jiang Scholar by the Ministry of Education of the People's Republic of China in 2014.

Kai-Wen Lan



Professor Lan is awarded a Morningside Silver Medal of Mathematics in August 2016, at the 7-th ICCM in Beijing.

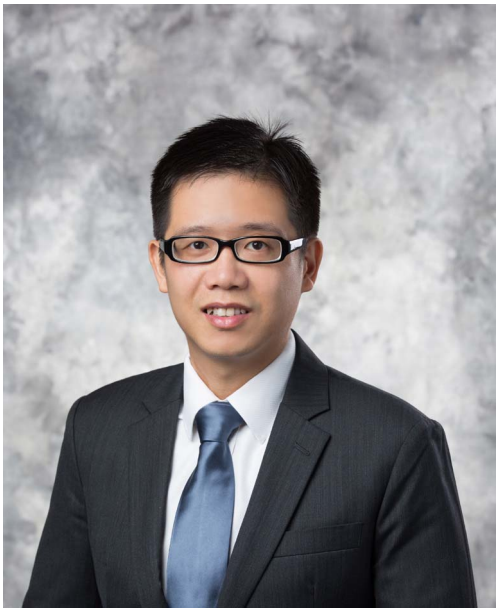
Citation Kai-Wen Lan is awarded a Silver Medal for his foundational works on the geometry and arithmetic of Shimura varieties and their compactifications. Since his thesis, his works on the integral models of compactifications of PEL-type Shimura varieties and Kuga families have played crucial roles in many recent developments in the Langlands program and in the theory of p-adic automorphic forms. In his joint work with Junecue Suh, they obtained general results on the vanishing and torsion-freeness of the cohomology of Shimura varieties, which have useful applications to modularity lifting methods. In his joint work with Michael Harris, Richard Taylor, and Jack Thorne, their construction of Galois representations for all cohomological automorphic representations over CM and totally real fields, without any duality condition, is a breakthrough in the Langlands program. He was awarded an National Science Foundation CAREER Grant and a Sloan Research Fellowship

in 2014, and is currently an associate professor at the University of Minnesota.

Response It is my great honor to receive the Morningside Silver Medal. Math research is never easy for me, but I have been very lucky to have witnessed and particpated in many exciting recent developments in my subject area, to have many interesting problems to think about, and to have been inspired and encouraged by many great colleagues and friends. All these helps, or sometimes challenges, have made my mathematical life much more enjoyable, and they really mean a lot to me. I sincerely thank all the people who have supported me.

Biographical sketch Kai-Wen Lan was born in Taipei in 1979, and obtained his B.S. and M.S. degrees from National Taiwan University in 1999 and 2001, respectively. After finishing his military service in 2003, he obtained his Ph.D. degree in 2008 from Harvard University under the advice of Richard Taylor, and then worked as a Veblen Research Instructor at Princeton University and the Institute for Advanced Study. He became an assistant professor at the University of Minnesota in 2012, and was promoted to an associate professor in 2015. His main research interests are in algebraic number theory and arithmetic geometry, and more particularly about the arithmetic properties of Shimura varieties and related geometric objects, and their applications to the theories of automorphic and Galois representations.

Ronald Lok Ming Lui



Professor Lui is awarded a Morningside Silver Medal of Mathematics in August 2016, at the 7-th ICCM in Beijing.

Citations Prof. Ronald Lui has been awarded the Morningside Silver Medal for his many deep and important contributions to areas of mathematics related to computational computational differential geometry. His pioneering works have led to an emerging interdisciplinary field: Computational Quasi-conformal Geometry (CQC), which has found important applications in various fields. Prof. Lui has systematically developed theories and computational methods for CQC, which have been successfully applied to different areas such as medical imaging, computer visions and geometry processing.

Dr. Lui and his collaborators observed that the discrete formulation of QC map is analogous to the continuous formulation of QC map on smooth manifolds. Thus, the discrete formulation provides a useful tool in computing quasiconformal structures on discrete meshes representing surfaces. He then developed methods combining discrete Ricci flow and metric modification to compute QC map. He then-Later, he extended the formulation to Teichmuller map (T-map) on point clouds and proposed an effective method to numerically approximate the T-map with high accuracy and efficiency. His algorithms can be used for large deformation QC registration even for high-genus surfaces.

The algorithms he developed are so versatile that it has been applied to various applications. In medical applications, these includes (i) fast brain surface conformal parameterization to simplify computations, (ii) brain surface registration for brain cortical surface comparison, (iii) vertebrae bone (high-genus surfaces) registration, and (iv) hHippocampal surface morphometry for analyzing Alzheimer's disease. In computer vision and graphics, these includes (i) facial recognition using Teichmuller distance, (ii) shape signature of multiply-connected objects using conformal weldings and conformal modules, (iii) point cloud meshing using spherical conformal parameterization and (iv) texture mapping using T-map.

In conclusion, Prof. Ronald Lui Ronald and his collaborators are the first to develop a discrete formulation of quasi-conformality on discrete surfaces (meshes or point clouds). They have developed a number of computational methods have been developed, which have shown to be effective and efficient. These works have led to an interdisciplinary field called Computational Quasi-conformal Geometry (CQC), with many applications such as medical imaging, computer visions, geometry processing, and computer graphics.

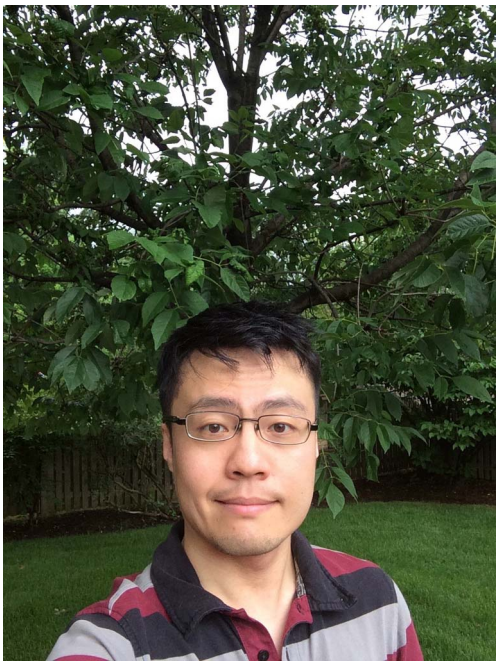
Response I feel deeply honoured to receive the 2016 Morningside Silver Medal. This award has given me a great deal of encouragement. I am truly thankful to the International Congress of Chinese Mathemati-

cians (ICCM) and the Selection Committee for choosing me to receive this prestigious award. I started my mathematical training at the Hong Kong University of Science and Technology (HKUST), where I was so lucky to have met many great mathematics teachers. In particular, I would like to express my sincere thanks to Prof. Shiu-Yuen Cheng and Prof. Kin Yin Li, who have both given me a lot of guidance in learning fundamental mathematics. After my undergraduate studies in HK, I was admitted to UCLA where I met my supervisor, Prof. Tony Chan, who has led me to the fascinating research topic of medical imaging using computation differential geometry. Prof. Tony Chan has given me a lot of guidance in many different aspects. I am deeply thankful to him for his teaching, constant support and encouragement. My sincere gratitude is also extended to Prof. Shing-Tung Yau, who was my mentor when I worked as a postdoctoral scholar at Harvard. He has introduced to me the interesting research direction about Computational Quasiconformal Geometry and inspired me a lot on applied mathematics research. Besides, I would also like to express my sincere thanks to my long-time collaborator, Prof. David Xianfeng Gu, who has taught me a lot about computational differential geometry and given me a lot of support in my career. In 2010, I joined The Chinese University of Hong Kong. I would like to take this opportunity to thank my colleagues, especially Prof. Raymond Chan and Prof. Jun Zou, who have given me a lot of encouragemnt. Finally, I would like to thanks my parents as well as my wife Sandra for their enormous love and support.

Biographical sketch Ronald Lok-ming Lui joined The Chinese University of Hong Kong in 2010, and he is now an Associate Professor at the Department of Mathematics. He received his B.Sc. degree from Hong Kong University of Science and Technology, and his M.Sc. and Ph.D. in Applied Mathematics from University of California at Los Angles (UCLA) under the supervisor of Prof. Tony Chan. He then worked as a Postdoctoral Scholar for 2 years at Harvard Math department, hosted by Prof. Shing-Tung Yau. Prof. Lui's research focuses on computational differential geometry and its applications to various fields. He introduced the discrete formulation of quasiconformal geometry on discrete surfaces and have developed a number of computational methods to compute quasiconformal structures. These works have led to an interdisciplinary field called Computational Quasiconformal Geometry (CQC), which has found many applications such as medical imaging, computer visions, geometry processing and computer graphics.

Jun Yin

Citation Professor Jun Yin has been awarded the 2016 Morningside Silver Medal for his important contributions to random matrix theory in probability theory.



Professor Jun Yin is awarded a Morningside Silver Medal of mathematics in August 2016, at the 7-th ICCM in Beijing.

Random matrix theory (RMT) has been being a very active field of research since 60's. The main fundamental reason, which is widely believed and originates with Wigner, is that random matrix statistics represents various highly correlated systems. Not like the Poisson statistics represents the independent system, this universality phenomenon about correlated system was not supported by any rigorous proof until 90s. At that time Deift, Its, Zhou, Pastur and Scherbina etc. proved that the universality phenomenon holds for invariant type random matrix ensembles. On the other hand, the conjecture asked by Wigner Dyson and Mehta on the universality phenomenon for Wigner type of random matrix has been open from 60s until recently. The main difficultly is, not like invariant random matrices, the Wigner type random matrices are not solvable models.

In a series of papers, J. Yin, with his collaborators L. Erdos and H. T. Yau etc., studied eigenvalue and eigenvector distributions of a large group of random matrix ensembles, and successfully proved the above Wigner–Dyson–Mehta conjecture. First in work with L. Erdos and H. T. Yau, Dr. Yin developed the self-consistent method in RMT and applied it on proving the rigidity property of Wigner type random matrices, which shows that random matrix has a surprising stability. Then in the work with Erdos, Knowles, Lee and Yau, J. Yin improved the comparison method

and showed how the local statistics of random matrix replies on the moments of matrix entries. This powerful tool turns out to be the key tool for calculating the necessary and sufficient condition of edge universality of Wigner matrices. Before Lee and Yin's proof, this condition even was not correctly predicted. At last, based on Dyson Brownian motion, with Bourgade, Erdos and Yau, they created a new dynamics method, which provided a new perspective of calculating the local statistics of random matrices.

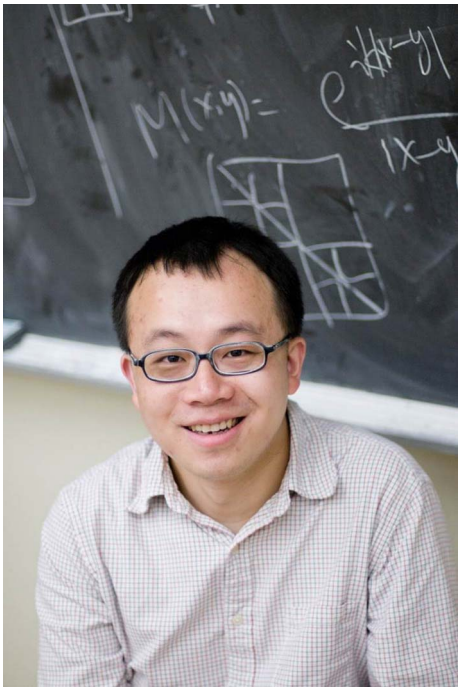
The proof of Wigner–Dyson–Mehta conjecture is based on combining above three new methods. Actually, the process of applying these three new ideas, i.e., three-step-method turns out to be a very powerful tool on studying various random matrix ensemble. Now it has become a standard process. The later work on covariance matrix, Erdos–Renyi graph, regular graph, non-mean field random matrix and non-Hermitian matrix are all relying on this strategy. Therefore, there is no doubt that J. Yin's work also has a very high citation number (1000) for junior researcher.

These examples make clear that Yin's work on random matrix theory has a deep impact in this field.

Response I would like to express my sincere gratitude l to the International Congress of Chinese Mathematicians and the Selection committee for choosing me as one of the recipients of 2016 Morningside Silver Award. As a physics Ph.D. I feel very lucky to have the chance to work on the mathematical fields and problems, which are related to physics. I started my professional mathematical training at Princeton. At there I had a great opportunity to study quantum many body system from Prof. Lieb and my advisor Robert Seringer. The mathematical beauty in their work inspired me to engage in mathematical research. I would like to express my sincere appreciation to their encouragement and advising. With the training in Princeton, later with Prof. Yau in Harvard, we successfully gave a breakthrough work on Lee–Yang's long time conjecture on the ground energy of interacting particle systems. My professional career started at Harvard University as a post doctor of H. T. Yau, who is the greatest influence on my career life. With modern viewpoints on random matrix theory, very fortunately with our coauthors, we proved Wigner–Dyson–Mehta conjecture. During my professional career, I also benefited a lot from learning from my other coauthors like Laszlo Erdos. From 2011, I joined the mathematics department of University Wisconsin at Madison, I greatly appreciated the freedom, the active events, and the stimulating culture that our department and group have been providing. I am also deeply indebted to my parents and my wife for their selfless love and enormous support.

Biographical sketch Jun Yin was born in Shanghai 1980. He received the B.S degree from USTC SCGY department in 2003 and the physics Ph.D. degree from Princeton University in 2008. During 2008–2011 he served as a Benjamin Peirce lecturer in Harvard mathematics department. From 2011 fall he joined University Wisconsin-Madison mathematics department as an assistant professor, and has been promoted to be associated professor from 2016 fall. In 2017, he will join University of California at Los Angeles. From 2013 to 2014, he worked as a Von Neumann research fellowship in Institute for Advanced Study at Princeton. He is mainly interested in quantum many body system and random matrix theory. With his coauthors, he proved Wigner–Dyson–Mehta conjecture in random matrix theory. He was one of the recipients of the Sloan research award in 2014.

Lexing Ying



Professor Ying is awarded a Morningside Silver Medal of Mathematics in August 2016, at the 7-th ICCM in Beijing.

Citation Lexing Ying is awarded the Morningside Silver Medal of Mathematics for his significant contributions to the development and analysis of fast methods in scientific computing. Professor Ying made many original and groundbreaking results on fast methods for solving partial differential equations, including:

(1) A kernel-independent adaptive fast multipole method, together with boundary integral meth-

od, to develop a high-order large-scale parallel fast solver for computational fluid dynamics in complex geometry, which is considered the best results on general integral kernel fast multipole method for the last twenty years.

(2) Several types of preconditioners, including sweeping/sparsifying/directional ones, to efficiently solve the Helmholtz equation, Lippmann–Schwinger equation, Maxwell's equations and other equations that are discretized by finite element method or finite difference method, which is a breakthrough in the area of fast methods for discrete wave equations.

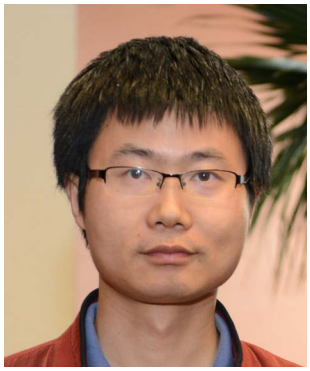
(3) The phase flow method to accurately and rapidly solve many initial-value ordinary differential equations, with extensive applications in computational physics and computational geometry.

(4) Other results, such as fast wave computation via multidimensional Fourier integral operators by butterfly algorithm, high-oscillatory integral kernel fast multipole method, hierarchical interpolative factorization for elliptic operators, fast multiscale Gaussian wavepacket transforms and multiscale Gaussian beams for the wave equation, and optimized local basis set for Kohn–Sham density functional theory.

Response I am very grateful to the International Congress of Chinese Mathematicians and the Selection committee for the 2016 Morningside Silver Award. I would like to use this opportunity to thank my mentors, colleagues and collaborators. Among them, special thanks go to Emmanuel Candes, Bjorn Engquist, Denis Zorin, and Weinan E. I would also like to thank my students and postdocs for the privilege of working with them. I thank my parents for providing me with the best education possible. And finally, I would like to thank my wife and daughters for their love and support.

Biographical sketch Lexing Ying received his Ph.D. from New York University in 2004 and was a postdoctoral scholar at Caltech from 2004 to 2006. From 2006 to 2012, he was a professor at The University of Texas at Austin. Since December 2012, he is a professor at Stanford University. His main research area is computational mathematics and scientific computing. He has received the Sloan Foundation Research Fellowship in 2007, the NSF Career award from National Science Foundation in 2009, the Feng Kang prize in Scientific Computing from Chinese Academy of Sciences in 2011, and the James H. Wilkinson Prize in Numerical Analysis and Scientific Computing from Society for Industrial and Applied Mathematics (SIAM) in 2013.

Zhiwei Yun



Professor Zhiwei Yun is awarded a Morningside Silver Medal of mathematics in August 2016, at the 7-th ICCM in Beijing.

Citation Professor Yun is awarded the 2016 Morningside Silver Medal of Mathematics for his fundamental contributions to the construction of motives with exceptional Galois groups, and his path-breaking work with Wei Zhang on the L-Series of rank 2 local systems on curves over finite fields. His research focuses on the interaction between algebraic geometry, number theory and representation theory of groups. He looks for ways to apply methods from one of these areas to solve problems in another. These problems are closely related to the conjectures of Langlands, and his works has lead to a geometric and functorial understanding of the Langlands program. Yun is also a recipient of the SASTRA Ramanujan Prize (2012).

Yun's recent work on the uniform construction of motives with exceptional Galois groups is considered to be a fundamental breakthrough. A construction like Yun's was sought by Serre and Grothendieck for over 40 years, and Yun's work is considered one of the most exciting developments in the theory of motives in the last two decades.

Yun has also made a major progress in the study of the Fundamental Lemma (Bao-Châu Ngô 2010 Fields Medal) formulated by Jacquet and Rallis in their program of proving the Gross–Prasad conjecture on relative trace formulas. Yun's understanding of Hitchin fibrations enabled him to reduce the Jacquet–Rallis fundamental lemma to appropriate cohomology.

In a seminal paper on Kloosterman sheaves for reductive groups, Ngô, Heinloth, and Yun reprove a unicity result of Gross on automorphic representations over the rational function field, and use the geometric Langlands theory to the construction of l-adic local systems.

In his more recent joint work with Wei Zhang, they have given a formula relating arbitrary order

central derivatives of L-functions to some algebraic cycles on moduli spaces of Drinfeld Shtukas. This beautiful piece yields the first result on a higher rank analogue of the Gross–Zagier theory. It puts before our very eyes arithmetic interpretation of higher order derivatives of L-functions which seems too good to come true.

Response I'm one of the very lucky people who have found their real interest and are living on it. More luckily, what I have done following my own interest is recognized by a broader community. I want to thank the initiators of the Morningside Awards and the ICCM selection committee for giving me the recognition. I'd like to thank my many teachers, from elementary school to graduate school and onward, who guided me through the desert and jungles and lead me closer to the Xanadu of mathematics. I'd like to thank my classmates at various stages many of whom are also mathematicians and some are collaborators of mine: it was impossible for me to have travelled this far alone. Of course, my parents and family have always been my strongest support, no matter which path I choose. I hope in the future I continue to have the privilege of pursuing mathematical beauty and truths without worrying too much about the outside world.

Biographical sketch Zhiwei Yun is currently a Professor of Mathematics at Yale University. He received his B.S. from Peking University, and his Ph.D. from Princeton University under R. MacPherson. He was a postdoc member of the Institute for Advanced Study, a CLE Moore instructor at MIT and an Assistant Professor and later Associate Professor at Stanford University. His main research area is geometric representation theory.