Lecture Series in Algebraic Geometry

Aug 26 – 30, 2019

Morningside Center of Mathematics CAS

Sponsors:

Academy of Mathematics and System Sciences, CAS,

Morningside Center of Mathematics,

National Science Foundation of China

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The conference “Lecture Series in Algebraic Geometry” will be held at **Morningside Center of Mathematics**, which was founded by Chinese Academy of Sciences in 1996 and **Professor Shing-Tung Yau** has been serving as the director of the center.

Registration Date & Location:

August 26, 2019, 8:10-9:10, MCM Building 1 Floor reception

Address: No. 55, Zhongguancun Eest Road, Haidian District, Beijing

地址：北京市海淀区中关村东路 55 号

Conference Time: August 26-30, 2019

Conference Venue: MCM Building 110

Address: No. 55, Zhongguancun Eest Road, Haidian District, Beijing

地址：北京市海淀区中关村东路 55 号

Website: www.mcm.ac.cn/activities/programs/2019LSAG

QR code of the conference:

Contact: Xiao Luo (罗潇) **Email: mcmoffice@math.ac.cn**

WeChat QR code:

Conference Staff:

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Location


Liaoning International Hotel
BANK OF CHINA
Youth Apartment, No 2 Building
MCM Building
WUKE Restaurant
South Building
Junma Hotel
AGRICULTURAL BANK OF CHINA
Walmart Supermarket
Fourth Ring Road
Subway, Line 13
Zhongguancun South 4th Street
Zhongguancun East Road
Zhongguancun South Road
Zhongguancun South 3rd Street
Zhongguancun South 2nd Street
Zhongguancun South 1st Street
Zhongguancun Street
Academy Science South Road
Zhichun Road
Zhongguancun 3rd Bridge
Zhongguancun 2nd Bridge
Zhongguancun North 2nd Street
Keyuan North 1st Street
Zhongguancun North 1st Alley
Zhongguancun Stop
Zhichunli
Walmart Supermarket
Carrefour supermarket

Invited Speakers

Junyan Cao	Sorbonne Université
Meng Chen	Fudan University
Ya Deng	University of Gothenburg
Zhizhong Huang	Leibniz Universität Hannover
Luc Illusie	Université Paris-Sud
Thomas Peternell	University of Bayreuth
Claire Voisin	Collège de France

Organizers

Baohua Fu	Morningside Center of Mathematics
Yujiro Kawamata	University of Tokyo / MCM
Shigeru Mukai	RIMS / MCM

Conference Schedule

August 26, 2019 (MCM 110)		
08:30-09:30	Registration：MCM Building First Floor reception	
09:30-10:30	Claire Voisin	The geometry of hyper-Kähler manifolds and their moduli (Ⅰ)
10:30-10:45	Coffee break, Group Photos (in front of the MCM building gate)	
10:45-11:45	Junyan Cao	A decomposition theorem for projective manifolds with nef anticanonical bundle (Ⅰ)
11:45-13:30	Lunch	
13:30-14:30	Ya Deng	On the hyperbolicity of moduli spaces (Ⅰ)
14:45-15:45	Meng Chen	Lectures on explicit anti-canonical geometry of weak Q-Fano 3-folds (Ⅰ)
15:45-16:00	Coffee break	
16:00-17:00	Thomas Peternell	The Miyaoka-Yau inequality, nonabelian Hodge correspondence and Uniformization of manifolds
August 27, 2019 (MCM 110)		
09:30-10:30	Junyan Cao	A decomposition theorem for projective manifolds with nef anticanonical bundle (Ⅱ)
10:30-10:45	Coffee break	
10:45-11:45	Claire Voisin	The geometry of hyper-Kähler manifolds and their moduli (Ⅱ)
11:45-13:30	Lunch	
13:30-14:30	Meng Chen	Lectures on explicit anti-canonical geometry of weak Q-Fano 3-folds (Ⅱ)
14:45-15:45	Junyan Cao	A decomposition theorem for projective manifolds with nef anticanonical bundle (Ⅲ)
15:45-16:00	Coffee break	
16:00-17:00	Claire Voisin	The geometry of hyper-Kähler manifolds and their moduli (Ⅲ)
17:30-20:00	Banquet	

August 28, 2019 (S202)		
8:30-9:30	Meng Chen	Lectures on explicit anti-canonical geometry of weak Q-Fano 3-folds (Ⅲ)
9:45-10:45	Zhizhong Huang	Rational points, from a Diophantine approximation point of view (Ⅰ)
10:45-11:00	Coffee break	
11:00-12:00	Luc Illusie	Old and new on the de Rham-Witt complex I
12:00-13:30	Lunch	
13:30	Free discussion	
August 29, 2019 (MCM 110)		
09:30-10:30	Thomas Peternell	The decomposition theorem for Ricci flat varieties
10:30-10:45	Coffee break	
10:45-11:45	Ya Deng	On the hyperbolicity of moduli spaces (Ⅱ)
11:45-13:30	Lunch	
13:30-14:30	Thomas Peternell	Differential forms and the abundance conjecture
14:45-15:45	Zhizhong Huang	Rational points, from a Diophantine approximation point of view (Ⅱ)
15:45-16:00	Coffee break	
16:00-17:00	Ya Deng	On the hyperbolicity of moduli spaces (Ⅲ)

Junyan Cao (Sorbonne Université)

A decomposition theorem for projective manifolds with nef anticanonical bundle

Let X be a projective manifold with numerically effective anticanonical bundle. By studying the Albanese map and the MRC fibration, we prove that its universal cover splits as \widetilde{X} =C^n \times Y \times Z, where Y is a projective manifold of trivial first Chern class and Z is rationally connected. It is a joint work with Andreas Höring. If the time is permitted, we explain also its generalization to the klt pair case, a recent joint work with Shin-Ichi Matsumura.

Meng Chen (Fudan University)

Lectures on explicit anti-canonical geometry of weak Q-Fano 3-folds

Three consistent lectures on weak Fano 3-folds will be given in this series. The first one is to introduce the basket theory, for weak Q-Fano 3-folds, inspired by Reid's R-R formula. As an application of the basket theory, we show the optimal lower bound of the anti-canonical volume for weak Q-Fano 3-folds. The third lecture is devoted to explaining the main idea in studying the anti-canonical geometry of weak Q-Fanos.

Ya Deng (University of Gothenburg)

On the hyperbolicity of moduli spaces

In this three-hour lecture, I will present recent developments on the hyperbolicity of moduli spaces of higher dimensional manifolds. The original motivation goes back to the Shafarevich-Viehweg-Zuo hyperbolicity conjecture: for maximally varying, smooth families of projective manifolds with semi-ample canonical bundle, the base spaces of such families should be of log general type. This deep conjecture motivated a lot of important work in last two decades, and was completely proved by Campana-P˘aun in 2015, building on the previous fundamental work by Viehweg-Zuo in 2002.

In Lecture 1, I will show that those base spaces are furthermore pseudo Kobayashi hyperbolic, i.e. Kobayashi hyperbolic modulo a proper Zariski subvariety, as predicted by the famous Lang conjecture: an algebraic variety is pseudo Kobayashi hyperbolic if it is of log general type. As a consequence, another conjecture by Viehweg-Zuo in 2003 is confirmed: moduli spaces of polarized manifolds with semi-ample canonical bundle are all Brody hyperbolic (no entire holomorphic curves). The main idea is to construct negatively curved (possibly degenerate) Finsler metrics on the bases via certain negatively twisted Higgs bundles (so-called Viehweg-Zuo Higgs bundles) initiated by Viehweg-Zuo in 2002, and such Finsler metrics are generically positively definite by proving some sort of infinitesimal Torelli theorem for Viehweg-Zuo Higgs bundle.

In Lecture 2, I will explain how to refine the methods in Lecture 1 to prove the Kobayashi hyperbolicity for moduli spaces of minimal general type manifolds (jointly with Dan Abramovich),

which generalizes a celebrated work by To-Yeung in 2015. I will also discuss how to extend Viehweg-Zuo's construction of their Higgs bundles to the logarithmic setting, to prove the hyperbolicity of bases of log Calabi-Yau families.

In Lecture 3, I will use quite different technique from that in Lectures 1 and 2, to prove that coarse moduli spaces of canonically polarized or polarized Calabi-Yau manifolds are Kobayashi hyperbolic in the sense of complex V -spaces (a generalization of complex V -manifolds in the sense of Satake). As an application, one can show that any smooth family of canonically polarized or polarized Calabi-Yau manifolds over a complex manifold with vanishing Kobayashi pseudo distance, is necessarily isotrivial, i.e. any two fibers are isomorphic. This can be seen as a hyperbolic version of Campana's isotriviality conjecture, proven by Taji in 2015, stating that any smooth projective family of canonically polarized manifolds over a "special manifold" (being opposite to general type manifolds) is isotrivial.

Zhizhong Huang (Leibniz Universität Hannover)

Rational points, from a Diophantine approximation point of view

The distribution of rational points on algebraic varieties is a basic subject in Diophantine geometry. Many surprising similarities between the distribution of rational points and rational curves have been witnessed, akin to the arithmetics over number fields and global function fields. Roughly speaking, the abundance of rational poins is essentially due to the presence of free rational curves.

The Batyrev-Manin-Peyre principle predicts global equi-distribution of rational points of bounded height on Fano varieties, provided that we remove an accumulation locus usually containing rational curves which are not free. Aiming at adding more evidence to the above analogy and obtaining finer information, we propose a local version, by counting rational points of bounded height which are close to a general point in real topology. In contrast to the global case, we expect that the accumulating locus to be removed contains rational curves though that point which are free but not very free. We establish it for several del Pezzo surfaces.

It turns out that this counting problem with Diophantine approximation is naturally related to the notion of approximation constant, invented by McKinnon and Roth. They discovered that this constant is deeply related to the Seshadri constant and used it to deduce a criterion for the existence of rational curves. As conjectured by McKinnon, the approximation constant attached to a given rational point should be achieved by a rational curve through that point. We prove this conjecture for many toric varieties.

Luc Illusie (Université Paris-Sud)

Old and new on the de Rham-Witt complex I

I will explain the motivations of the construction, and review the basic definitions and properties of the de Rham-Witt complex.

Thomas Peternell (University of Bayreuth)

Lecture 1: *The Miyaoka-Yau inequality, nonabelian Hodge correspondence and Uniformization of manifolds*

The Miyaoka-Yau inequality is one of the corner-stones in the classification theory of algebraic manifolds with ample canonical class. Particularly interesting is the case of equality, when the manifold is uniformized by the ball. I will discuss the generalization to minimal models of varieties of general type (joint work with Greb, Kebekus and Taji).

Lecture 2: *The decomposition theorem for Ricci flat varieties*

I will discuss the Beauville- Bogomolov decomposition for minimal models of Kodaira dimension zero, i.e., normal projective varieties with only canonical (or klt) singularities and trivial canonical class (joint work with Höring).

Lecture 3: *Differential forms and the abundance conjecture*

I will report on joint work with V. Lazic on the nonvanishing and abundance conjecture for complex varieties pseudoeffective canonical class.

Claire Voisin (Collège de France)

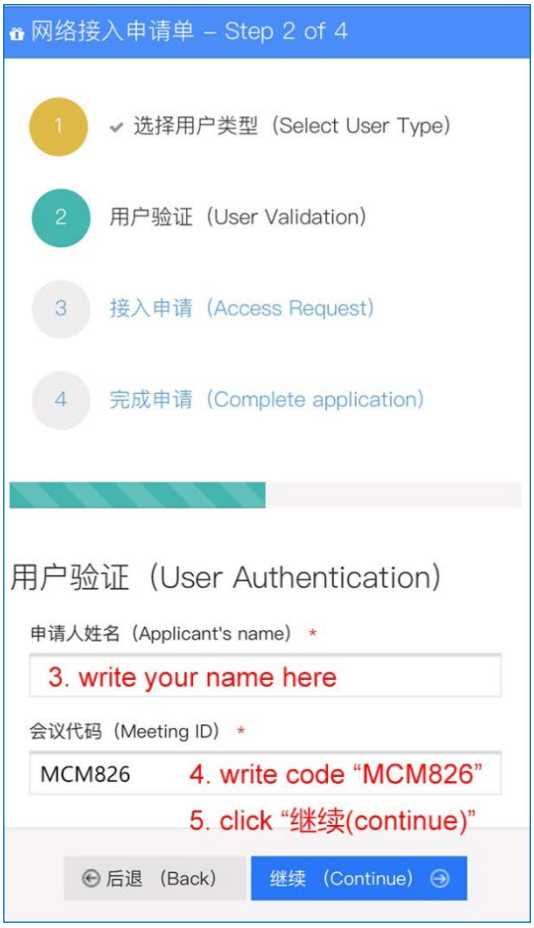
The geometry of hyper-Kähler manifolds and their moduli

I will describe several explicit projective models of hyper-Kähler manifolds built from Fano geometry. I will explain how to compute their deformation type.

I will also discuss a conjectural picture concerning the Chow ring of hyper-Kähler manifolds, and the notions of surface decomposition and triangle variety.

WIFI

- ☐ Open your wifi and connect the SSID (wifi name) **AMSS**.
- ☐ Open a browser window and type any website address.
- ☐ It will redirect to a register form. Fill the form with Conference ID **MCM826.**



More Lectures

First week: 26th-30th August

	Monday	Tuesday	Wednesday（S202）	Thursday
9:30-10:30	Claire Voisin (Ⅰ)	Junyan Cao (Ⅲ)	**8:30-9:30** Meng Chen(Ⅲ) **9:45-10:45** Zhizhong Huang(Ⅰ) **11:00-12:00** Luc Illusie(Ⅰ)	Thomas Peternell(Ⅱ)
10:45-11:45	Junyan Cao (Ⅰ)	Claire Voisin (Ⅱ)		Ya Deng (Ⅱ)
13:30-14:30	Ya Deng (Ⅰ)	Meng Chen (Ⅱ)	Free discussion	Thomas Peternell(Ⅲ)
14:45-15:45	Meng Chen (Ⅰ)	Junyan Cao (Ⅱ)		Zhizhong Huang(Ⅱ)
16:00-17:00	Thomas Peternell(Ⅰ)	Claire Voisin (Ⅲ)		Ya Deng (Ⅲ)

Second week: 2nd-6th September

	Monday	Tuesday	Wednesday	Thursday
9:30-10:30	Conan Leung / Ying Xie(Ⅰ)	Zhiyuan Li (Ⅱ)	Free discussion	Laurent Manivel (Ⅲ)
10:45-11:45	Junyi Xie (Ⅰ)	Laurent Manivel (Ⅱ)		Yoshinori Namikawa(Ⅲ)
13:30-14:30	Zhiyuan Li (Ⅰ)	Yoshinori Namikawa (Ⅱ)		Junyi Xie (Ⅲ)
14:45-15:45	Laurent Manivel (Ⅰ)	Junyi Xie (Ⅱ)		Zhiyuan Li (Ⅲ)
16:00-17:00	Yoshinori Namikawa(Ⅰ)	Conan Leung / Ying Xie(Ⅱ)		Shilin Yu

Third week: 16th-20th September

	Monday	**Tuesday**	**Thursday**	**Friday**
9:30-10:30	Stéphane Druel (Ⅰ)	Fedor Zak (Ⅰ)	Qizheng Yin (Ⅱ)	Zhiyu Tian (Ⅱ)
10:45-11:45	Jun-Muk Hwang (Ⅰ)	Stéphane Druel (Ⅱ)	Fedor Zak (Ⅱ)	Qizheng Yin (Ⅲ)
13:30-14:30	Keiji Oguiso (Ⅰ)	Jun-Muk Hwang (Ⅱ)	Stéphane Druel (Ⅲ)	Free discussion
14:45-15:45	Qizheng Yin (Ⅰ)	Keiji Oguiso (Ⅱ)	Jun-Muk Hwang (Ⅲ)	
16:00-17:00	Katsuhisa Furukawa	Zhiyu Tian (Ⅰ)	Keiji Oguiso (Ⅲ)	

Fourth week: 23th-27th September

	Monday	**Tuesday**	**Thursday**	**Friday**
9:30-10:30	Yunfeng Jiang (Ⅰ)	Yunfeng Jiang (Ⅱ)	Yukinobu Toda (Ⅲ)	Free discussion
10:45-11:45	Yalong Cao (Ⅰ)	Yukinobu Toda (Ⅱ)	Yalong Cao(Ⅲ)	
13:30-14:30	Yukinobu Toda (Ⅰ)	Yalong Cao (Ⅱ)	Yunfeng Jiang (Ⅲ)	