

# Derived category of coherent sheaves

Noobs

July 15, 2023

## Abstract

This is an informal seminar on derived category of coherent sheaves. The main reference is [Huy06], which is recommended by Sasha Kuznetsov. We mainly refer to [Har13] for algebraic geometry and to [GM13] for homological algebra.

## 1 Schedule

Starting from 18:30, the seminar takes place at 近春园西楼报告厅 in the spring semester of 2023. We move to 近春园西楼第一会议室 since 5th June. The seminar will be postponed if there are more important issues.

**Lecture 1 (2023/02/20)** Review on algebraic geometry and homological algebra: abelian categories of modules and coherent sheaves. See [Har13] and [GM13].

**Speaker:** 张鼎新

**Lecture 2 (2023/02/27)** Derived category of an abelian category & derived functors. See Chapter 2 in [Huy06].

**Speaker:** 唐龙天

**Lecture 3 (2023/03/04)** Abstract notion: triangulated category, semi-orthogonal decomposition, exceptional collections. See Chapter 1 in [Huy06].

**Speaker:** 张鼎新

**Lecture 4 (2023/03/20)** Derived functors in algebraic geometry, Serre and Grothendieck–Verdier duality. See Chapter 3 in [Huy06].

**Speaker:** 唐龙天

**Lecture 5 (2023/03/27)** Fourier–Mukai transform. See Chapter 5 in [Huy06].

**Speaker:** 任建宇

**Lecture 6 (2023/04/03)** Equivalence criteria. See Chapter 7 in [Huy06].

**Speaker:** 任建宇

**Lecture 7 (2023/04/10)** Derived category & canonical bundle. See Chapter 4 & 6 in [Huy06].

**Speaker:** 苏晓羽

**Lecture 8 (2023/04/17)** Derived category & canonical bundle (cont’d). See Chapter 4 & 6 in [Huy06].

**Speaker:** 苏晓羽

**Lecture 9 (2023/05/01)** Derived category of curves and  $\mathbb{P}^n$ . See [Bei78].

**Speaker:** 李心宇

**Lecture 10 (2023/05/08)** Spherical objects. See Chapter 8 in [Huy06].

**Speaker:** 蒋昕童

**Special Lecture (2023/05/22)** Homological mirror symmetry.

**Speaker:** 周杰

**Lecture 11 (2023/05/29)** Background on abelian varieties.

**Speaker:** 张鼎新

**Lecture 12 (2023/06/05)** Derived categories of abelian varieties. See Chapter 9 in [Huy06].

**Speaker:** 唐龙天

**Lecture 13 (2023/06/12)** Background on K3 surfaces.

**Speaker:** 余成龙

**Lecture 14 (2023/06/20)** Derived categories of K3 surfaces. See Chapter 10 in [Huy06].

**Speaker:** 蒋昕童

~~**Lecture 15 (2023/06/22)** Stability conditions. See [Huy14].~~

~~**Speaker:** 许福临~~

~~**Lecture 16 (2023/06/24)** Stability conditions (cont'd). See [Huy14].~~

~~**Speaker:** 许福临~~

\*The last two talks are cancelled. Instead, we will watch the [series of lectures](#) by Emanuele Macri.

## References

- [Bei78] Alexander A Beilinson. Coherent sheaves on  $\mathbb{P}^n$  and problems of linear algebra. Functional Analysis and Its Applications, 12(3):214–216, 1978.
- [GM13] Sergei I Gelfand and Yuri I Manin. Methods of homological algebra. Springer Science & Business Media, 2013.
- [Har13] Robin Hartshorne. Algebraic geometry, volume 52. Springer Science & Business Media, 2013.
- [Huy06] Daniel Huybrechts. Fourier-Mukai transforms in algebraic geometry. Clarendon Press, 2006.
- [Huy14] Daniel Huybrechts. Introduction to stability conditions. Moduli spaces, 411:179–229, 2014.