

# Oral Exam Syllabus

Sarah Frei

---

## Books

- D. Eisenbud and J. Harris, *3264 and all that: A second course in algebraic geometry*, Cambridge University Press, 2016.  
Chapters 1, 2, 5, 6 (The Chow ring, computing Chow rings and Chow classes, Chern classes, Fano and Hilbert schemes, tangent spaces to Fano/Hilbert schemes)
- D. Huybrechts, *Lectures on K3 surfaces*, draft, [www.math.uni-bonn.de/people/huybrech/K3Global.pdf](http://www.math.uni-bonn.de/people/huybrech/K3Global.pdf), 2014.  
Chapters 1, 4, 9, 10, 16 (definitions and invariants, Weil conjectures, lifting K3 surfaces, moduli spaces of sheaves on K3 surfaces, derived categories of K3 surfaces)
- D. Huybrechts, *Complex geometry: an introduction*, Springer Science & Business Media, 2006.  
Chapters 3, 4, 5 (Hodge theory on Kähler manifolds, computing a Hodge diamond, Serre duality, Chern classes, Hirzebruch-Riemann-Roch, Kodaira vanishing)

## Papers

- Charles, François. “Birational boundedness for holomorphic symplectic varieties, Zarhin’s trick for K3 surfaces, and the Tate conjecture.” *arXiv preprint arXiv:1407.0592* (2014).  
Lifting K3 surfaces, isomorphism between  $v^\perp$  and  $H^2(\mathcal{M}_H(v)_{\bar{k}}, \mathbb{Z}_\ell(1))$
- Briançon, Joël. “Description de  $\text{Hilb}^n \mathbb{C}\{x, y\}$ .” *Inventiones mathematicae* 41.1 (1977): 45-89.  
Description of  $\text{Hilb}^n \mathbb{C}[[x, y]]$  for small  $n$  (Section IV)
- Harvey, David, Brendan Hassett, and Yuri Tschinkel. “Characterizing projective spaces on deformations of Hilbert schemes of K3 surfaces.” *Communications on Pure and Applied Mathematics* 65.2 (2012): 264-286.  
Decomposition of the cohomology representation, examples for  $S^{[2]}$  and  $S^{[3]}$  where  $S$  is a K3 surface (Section 4)

## Courses

- Math 607 *Weil Conjectures*, Dugger, Fall 2015.  
The Weil conjectures, Étale coverings, Étale cohomology
- Math 607, *Homological Algebra*, Elias, Spring 2016.  
Derived functors, triangulated categories, homotopy and derived categories
- Math 607, *Moduli Spaces of Sheaves*, Addington, Winter 2017.  
Examples of moduli spaces, stable and semi-stable sheaves, moduli spaces of sheaves on K3 surfaces