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Vanishing theorems, generic vanishing theorems and applications
University of Milano, 25th January 2016 - 3th February 2016

Tentative program:

1. Classical vanishing theorems: Kodaira, Nakano, Kawamata-Viehweg
2. Genering vanishing theorems (with preliminars on Abelian Varieties)
3. Derived categories, Fourier-Mukai transform and derived vanishing theorems.
4. Applications to AV and irregular varities: racionality of the singularities of the theta divisor representing a principal polarization (Ein-Lazarsfeld), derived approach to Torelli Theorems, bicanonical map for varieties of maximal Albanese dimension, characterization of theta divisors, higher Castelnuovo-Severi inequality,...

References

Lazarsfeld's book on positivity (first volume)
Birkenhake-Lange: Complex Abelian Varieties
Griffiths-Harris: Principles of Algebraic Geometry [GL87]
M. Green and R. Lazarsfeld, Deformation theory, generic vanishing theorems, and some conjectures of Enriques, Catanese and Beauville, Invent. Math. 90 (1987), no. 2, 389407.
[GL91] , Higher obstructions to deforming cohomology groups of line bundles, J. Amer. Math. Soc. 4 (1991), no. 1, 87103.
[Hac04] C. D. Hacon, A derived category approach to generic vanishing, J. Reine Angew. Math. 575 (2004), 173187.
[PS13] M. Popa and C. Schnell, Generic vanishing theory via mixed Hodge modules, Forum Math. Sigma 1 (2013), e1, 60. The following articles contain various examples and applications of the theory. We will be discussing most of them over the course of the semester.
[EL97] L. Ein and R. Lazarsfeld, Singularities of theta divisors and the birational geometry of irregular varieties, J. Amer. Math. Soc. 10 (1997), no. 1, 243258. [CH01] J. A. Chen and C. D. Hacon, Characterization of abelian varieties, Invent. Math. 143 (2001), no. 2, 435447.
[Par12] G. Pareschi, Basic results on irregular varieties via Fourier-Mukai methods, Current developments in algebraic geometry, Math. Sci. Res. Inst. Publ., vol. 59, Cambridge Univ. Press, Cambridge, 2012, pp. 379403.
Mukai paper on Fourier transform
Beilinson Polishchuck: Torelli
Polishchuck book Abelian varieties
Pareschi Popa: Higher Castelnuovo
Barja Lahoz Naranjo Pareschi: Bicanonical map of irregular varieties