

ADVANCED SEMINAR IN GEOMETRY AND TOPOLOGY, 1  
“MODULI OF CURVES” 0366485601  
(FALL SEMESTER, 2011-12)

Lecturer: Prof. E. Shustin

Time and place: Thursday 10-12 in Schreiber 209.

### Program

1. *Parameter spaces.* Parameters and moduli. Construction of the Hilbert Scheme. Tangent space to the Hilbert scheme. Examples. Dimension of the Hilbert scheme. Severi varieties. Hurwitz schemes.

2. *Moduli spaces of curves.* Fine and coarse moduli spaces. Examples. Construction of  $\mathcal{M}_g$ . Geometric and topological properties of moduli spaces of curves. Moduli spaces of stable maps.

3. *Technical tools.* Nodal and stable curves. Deformation theory. Stable reduction. Moduli stack. Grothendieck-Riemann-Roch and Porteous formulas. Example: hyperelliptic curves in  $\mathcal{M}_3$ .

4. *Construction of  $\overline{\mathcal{M}}_g$ .* Geometric invariant theory approach. Hilbert points of smooth curves. The potential stability theorem.

5. *Limit linear series and Brill-Noether theory.* Limits of line bundles and linear series. Limit linear series. Limits of canonical series and Weierstrass points. Gieseker-Petri theorem.

6. *Geometry of moduli spaces.* Irreducibility. Diaz' theorem. Moduli of hyperelliptic curves. Ample divisors on  $\overline{\mathcal{M}}_g$ . Irreducibility of Severi varieties. Kodaira dimension of  $\mathcal{M}_g$ .

Participants will be suggested to give talks by their choice.

Preliminary knowledge of basics in algebraic geometry should be sufficient.

### Literature:

*Main reading:* J. Harris and I. Morrison. Moduli of curves. Springer, 1998.

*Other sources:*

E. Arbarello, M. Cornalba, P. Griffiths, and J. Harris. Geometry of algebraic curves, I. Springer, 1985.

E. Arbarello, M. Cornalba, P. Griffiths, and J. Harris. Geometry of algebraic curves, II. 2011.