MAT 1126HS Instructor: B. Khesin

Graduate course "Lie Groups and Hamiltonian PDEs" Spring 2013

Topics for minipapers:

1. Classify the coadjoint orbits for the group $Diff(S^1)$.

2. Derivation of the Camassa–Holm equation as the H^1 -Euler equation on the Virasoro group. Peakons.

3. Derivation of the H^1 -Euler equation on the SDiff(M) for a manifold M, possibly with boundary.

4. Hunter-Saxton equation as an Euler equation for $Diff(S^1)$ and geodesics on infinite-dimensional sphere.

5. Derivation of the gas dynamics (or compressible fluid) equation as an Euler equation.

6. Describe Casimirs for the semidirect product group $Diff(M) \times C^{\infty}(M)$.

7. Derivation of the MHD/Kirchhoff equations as the Euler equations.

8. Symplectic structure on polygons as an approximation of the symplectic structure on arc-parameterized curves in \mathbb{R}^3 .

9. Find the recurrence and explicit formulas for the KdV conservation laws.

10. First integrals of the KdV from the WKB asymptotics.

11. Describe the coadjoint orbits of the Etingof–Frenkel algebras over \mathbf{C}^* .

12. Derivation of the rational, trigonometric or elliptic Calogero–Moser system as a reduction from the simple, affine or elliptic algebra (reference: Gorsky–Nekrasov)

13. Find an analog of the Weinstein theorem on the local structure of Poisson manifolds in infinite dimensions.

14. Poisson properties of the Hasimoto transformations from the binormal (filament) equation to the NLS one.

15. Kahler structure on the Virasoro coadjoint orbits (ref: Kirillov).

16. Torus action on the moduli of flat SU(2)-connections on a Riemann surface (ref: Jeffrey–Weitsman)

17. Moduli of graph connections and Poisson structures on them (ref: Fock–Rosly).

(Topics outside of the list are also possible: please, discuss with the instructor.)