

NCSU Mathematics Department

MA 792J-002 – Representations of infinite-dimensional Lie algebras

Spring 2009, MWF 2:30-3:20 pm, HA 272

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Tentative Plan of Lectures:

1. Irreducible finite-dimensional representations of $sl(2)$
2. Euclidean and Hermitian vector spaces
3. Unitary representations of Lie algebras
4. Shapovalov form for $sl(2)$. The 3-dimensional Heisenberg algebra
5. The Heisenberg algebra and the Fock space
6. Properties of the Fock space
7. Representation of the Virasoro algebra on the Fock space
8. Unitarity and complete reducibility of the Fock space
9. Highest weight representations of the Virasoro algebra
10. Verma modules over the Virasoro algebra
11. Singular vectors
12. Shapovalov form on $M(c,h)$
13. Degeneracy, unitarity, and the matrix of the Shapovalov form
14. The Kac determinant formula
15. Consequences of the Kac determinant formula