

Schedule of talks

Monday	Topics	Reading
9-9:45 and 10-10:45, Classical Field Theory	Lagrangians, Euler-Lagrange equation, symmetries and Noether's theorem. Examples: Mechanics, scalar fields, gauge fields.	[IAS1] Deligne&Freed, Classical Field Theory. [F1] Lects 1-3 Supplemental: DeWitt, Dynamical Theory of groups and fields
11-11:45 and 12-12:45, Quantization of Free Fields	Heisenberg and Clifford algebras and their representations. Stone-von Neumann and Shale's theorems. Scalar fields, wave equation and its quantization. Poincaré group and its representations	Segal, CMP 80 (1981). Pressley-Segal, Loop Groups [IAS1] Kazhdan, Lects. 1-4. Wigner, Ann. Math 40 (1939)
2:00-2:45, Supermanifolds		[IAS1] Deligne&Morgan, 2 and 3 through 3.7 and 4.1-4.5 Manin, Complex Geometry and Gauge Theory
3:00-3:45, Supersymmetric quantum mechanics		[CMI] Chs. 8,9,10. [F1] Lecture 4. [T]. [IAS1] Homework problems FP1, FP2
4:15-5, Morse theory via supersymmetry		[Wi1]
5:15-6, The Atiyah-Singer Index theorem		Getzler&Vergne, Heat kernels and Dirac operators (backgd on index theorem) [IAS1] Witten's 'Dirac operators' contribution, Lecture 1. Alvarez-Gaumé CMP 90 (1983). Atiyah, Asterisque 131 (1985)
Tuesday		
9-9:45 and 10-10:45, Gauge theory in 2 dimensions	Finite group gauge theory. Yang-Mills theory for compact Lie groups and its topological limit. Integration over moduli space of flat connections.	Dijkgraaf&Witten, CMP 129 (1990). Witten, CMP 141 (1991). [IAS2], Witten's QFT course, Lecture 11. Greg Moore's Les Houches lectures, hep-th 9411210. Segal, Lecture 1 at http://www.cgtp.duke.edu/ITP99/segal/ Sengupta, CM183, 1997 for some rigorous foundations
11-11:45 and 12-12:45, The super-Poincaré group and its representations	The super-Poincare algebra. R-symmetry and central charges Examples in 2d (vector representation) and 4d. BPS representations	[F1] Lecture 6. [F2] Lecture 3 [online]. [IAS2] Witten's QFT course Lect 12
2:00-2:45 and 3:00-3:45, Supersymmetric Lagrangians and classical field theories	Generalities. Supersymmetric Sigma-models in 1d, 2d. Elliptic genus?	[IAS1] Deligne&Freed, Supersolutions, Chs. 1,3 [IAS1] Witten's Dirac op. Lecture 2
4:15-5 and 5:15-6, Topological twisting and sigma-models	A- and B-models with target a Kaehler manifold.	[Wi3] , [CMI] Chs. 15-16

Wednesday		
9-9:45: N=2 supersymmetric Yang-Mills theory	Field content. Lagrangian. Classical solutions.	[IAS2] Witten QFT course, lectures 17-19 (omit difficult QFT considerations) [IAS1], Deligne&Freed Supersolutions Ch.8
10-10:45: Abelian duality		[IAS2] Witten's QFT course, Lecture 8
11-12:30 Dynamics of quantum field theory - Examples	N. Nekrasov	
FREE AFTERNOON		
Thursday		
9-9:45 and 10-10:45, Topological and smooth manifolds	Smooth and topological manifolds, emphasis on dimension 4. Freedman's classification. The Donaldson invariants. Constraints on the intersection form in the smooth case.	Donaldson&Kronheimer, I. Gompf&Stipsicz, Ch I Kronheimer&Mrowka, Bull. AMS 30, 1994
11-12:30, Seiberg-Witten theory	Claude LeBrun	
2:00-4, QFT interpretation of the Donaldson/Seiberg-Witten relation	Greg Moore	
Friday [Note special times!]		
9:00-10:25, N=4 gauge theory in 4 dimensions and S-duality	Safronov: Basics, topological twists, Hitchin spaces	http://arxiv.org/abs/hep-th/0604151
10:30-12:00, A-/B-model branes and D-modules	Beraldo: Mirror symmetry. Nadler-Zaslow theorem	
1:00-2:25, Geometric Langlands correspondence and 4D gauge theory	Edward Frenkel	http://arxiv.org/abs/0906.2747 , http://arxiv.org/abs/0710.5939
2:30-4:00, Branes and representations	Sergei Gukov	http://arxiv.org/abs/0809.0305
There is a train to NYC at 4:18pm.		

Basic references:

IAS 1,2: IAS Princeton volumes from the 96-97 special year in QFT CMI: Clay Math Institute Monographs, Hori et al, Vol.1	Fo: Folland, Quantum Field theory for mathematicians, AMS 2008
D: Dijkgraaf, Les Houches lectures 1995 http://arxiv.org/pdf/hep-th/9703136v1	T: Takhtajan, Quantum mechanics for mathematicians, AMS 2008
F1: Freed, Classical Field theory and supersymmetry, Park City lecture notes, http://www.math.utexas.edu/users/dafr/pcmi.pdf	W1,2,3: Weinberg, Quantum theory of fields 1,2,3
F2: Freed, Five lectures on supersymmetry [online]	Wi1: Witten, Morse Theory and Supersymmetry
	Wi2: Witten, Topological quantum field theory
	Wi3: Witten, Mirror manifolds and topological field theory