QFT and Representation Theory
MAT 280, winter 2016, Fridays 8:40-11:50am in MSB 2112

Instructor: Tudor Dimofte

Tentative syllabus:

Week	Topics
1	what is a QFT? 0d QFT, 0d SUSY, superfields, superspace path integrals and localization
2	homology, cohomology, harmonic theory 1d QFT: quantum mechanics de Rham QM, Gauss-Bonnet theorem, potentials and Morse theory, E_1 algebras
3	Dolbeault QM parameter spaces and the Berry connection, sheaves of QM theories
4	Global and gauge symmetry models for equivariant cohomology twisted masses and the cosmological constant homological G-actions in QM
5	physics of 2d $\mathcal{N} = (2, 2)$ theories rings of operators and E_2 algebras quantum cohomology T-duality and mirror symmetry
6	2d TQFT and Frobenius algebras BPS boundary conditions for 2d theories a bit of homological algebra descent and cone constructions the derived category for $\mathbb{C}$ and basic Koszul duality
7	Fukaya and Fukaya-Seidel categories basic homological mirror symmetry 2d gauge theory and boundaries Koszul duality and equivariant cohomology (Goresky-MacPherson)
8	physics of 3d $\mathcal{N} = 2$ and $\mathcal{N} = 4$ theories the zoo of BPS objects in 3d moduli spaces and local operators a bit of hyperkähler geometry E_3 algebras, Poisson brackets, and quantization
9	homological construction of the 3d Coulomb branch boundary conditions and D-modules basic symplectic duality Rozansky-Witten TQFT the Kapustin-Rozansky-Saulina 2-category categorical G-actions
10	time permitting: intro to 4d gauge theory and Geometric Langlands *or* general TQFT and the cobordism hypothesis