MINI-COURSES
(Three 1h talks)

Alexander Kleshchev (University of Oregon at Eugene, USA)
Title: Representation theory of symmetric groups and related Hecke algebras
Abstract: We survey some fundamental trends in representation theory of symmetric groups and related objects which became apparent in the last fifteen years. The emphasis is on connections with Lie theory via categorification. We present results on branching rules and crystal graphs, decomposition numbers and canonical bases, graded representation theory, connections with cyclotomic and affine Hecke algebras, Khovanov-Lauda-Rouquier algebras, category $\mathcal{O}$ and W-algebras.

Ron Donagi (University of Pennsylvania, USA)
Title: Geometric Langlands Conjectures
Abstract: These talks will introduce and explore the Langlands conjectures and especially their geometric versions. These conjectures are at the boundary of algebraic geometry and representation theory. Deep connections to quantum field theory have been unearthed in recent years. The conjectures require existence of a large class of "automorphic objects", or automorphic sheaves in the geometric setting. They are essentially non-abelian: the abelian case, class field theory, is well understood. I will survey much of the background as time permits. In particular, I will state, explain and outline a proof of the classical limit of the geometric Langlands conjecture, which says that the Hitchin integrable system for a simple complex Lie group G is dual to the Hitchin system for the Langlands dual group $\{^L\}G$. We will explore the two ways that this result relates to the full "quantum" conjecture: it is its classical limit, but may also be equivalent to the full conjecture via a twistor construction. This leads to a physics inspired program to establish the conjecture with the use of non-abelian Hodge theory.

Duiliu Emmanuel Diaconescu (Rutgers University, USA)
Title: ADHM Sheaves, wall-crossing and Local BPS Invariants
Abstract: ADHM invariants are equivariant virtual invariants of moduli spaces of twisted cyclic representations of the ADHM quiver in the abelian category of coherent sheaves on a smooth complex projective curve. This talk will present a generalization of this construction employing a more general stability condition which depends on a real parameter. Two wallcrossing results are proved using Joyce's results on configurations in abelian categories and the theory of generalized Donaldson-Thomas invariants of Joyce and Song. Applications to local Pandharipande-Thomas theory and local Gopakumar-Vafa theory will be presented as well.