C. Simpson—Talks at the University of Cambridge
Oct. 30th-Nov 6th, 2007

General talk (Kuweit lectures):

"The shape of an algebraic variety"

Abstract: An algebraic variety X over the complex numbers has, as one of its main facets, a topological space X^{top}. The study of X^{top} has played an important role in the history of algebraic geometry. We will present a way of measuring the "shape" of X^{top} by considering maps from it into different targets. The targets T, which are like spaces, are also profitably viewed as n-*stacks*, a notion from higher category theory. The complex algebraic structure of X leads to a number of different structures on $Hom(X^{\mathrm{top}}, T)$. For example when $T = BG$, the mapping stack $Hom(X^{\mathrm{top}}, BG)$ may be viewed as the moduli space of G-bundles with integrable connection, or principal G-Higgs bundles. These fit together into Hitchin's *twistor space*. Consideration of these structures is a good way of organizing the investigation of the topology of complex algebraic varieties.

Seminar talk (Algebraic geometry seminar):

"Regulators of canonical extensions"

Abstract: Suppose X is a smooth projective variety with normal crossings divisor D. A flat connection on $U := X - D$ with unipotent monodromy around components of D leads to the *Deligne canonical extension*, a bundle $\overline{E}$ over X such that the connection ∇ has logarithmic poles and nilpotent residues. We would like to define Chern-Simons regulators for $(\overline{E}, \nabla)$ in $H^{2p-1}(X, \mathbf{C}/\mathbf{Z})$, and prove the *Reznikov theorem* that they are torsion in the algebraic case. The latter should be a consequence of T. Mochizuki's theorem about deforming a representation to a variation of Hodge structure. In joint work with J. Iyer, we have been able to do this in the first case when D is smooth. Deligne and Esnault have sent ideas for the general normal crossings case.