

**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  $X^{\text{top}}$ . The study of  $X^{\text{top}}$  has played an important role in the history of algebraic geometry. We will present a way of measuring the “shape” of  $X^{\text{top}}$  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  $\text{Hom}(X^{\text{top}}, T)$ . For example when  $T = BG$ , the mapping stack  $\text{Hom}(X^{\text{top}}, BG)$  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  $\nabla$  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.