LTCC Basic Course

Title: Applications of Differential Geometry to Mathematical Physics

Basic Details:
- Core Audience: 1styr; interested 2nd/3rdyr can also attend; the course is suitable for both pure and applied mathematicians).
- Course Format: **Extended**: 5 x 2hr lectures

Course Description:
- Keywords: Manifolds, fibre bundles, gauge theory, Hamiltonian mechanics
- Syllabus: The course will illustrate how concepts in differential geometry arise naturally in different areas of mathematical physics. We will describe manifolds, fibre bundles, (co)tangent bundles, metrics and symplectic structures, and their applications to Lagrangian mechanics, field theory and Hamiltonian systems, including various examples related to integrable systems and topological solitons.

- Recommended reading:
  (1) V. I. Arnold, *Mathematical Methods of Classical Mechanics*. Graduate Texts in Mathematics, Vol. 60. Springer-Verlag (1978).
  (2) T. Frankel, *The Geometry of Physics*, 3rd edn. Cambridge University Press (2012).
  (3) M. Nakahara, *Geometry, Topology and Physics*. Graduate Student Series in Physics, 2nd edn. Institute of Physics (2003).

- Additional Optional reading:
  (1) O. Babelon, D. Bernard and M. Talon, *Introduction to Classical Integrable Systems*. Cambridge Monographs on Mathematical Physics. Cambridge University Press (2007).
  (2) N. J. Manton and P. M. Sutcliffe, *Topological Solitons*. Cambridge Monographs on Mathematical Physics. Cambridge University Press (2004).
- Prerequisites: Undergraduate linear algebra, group theory, differential equations; elementary mechanics is desirable but not essential.

Format:
- No of discussion/problem sheets: 4
- Electronic lecture notes: book chapter provided
- Necessary software requirements for computing facilities: none
- Proposed timing: Jan-Feb session, 1-3pm
- Lecture/computer session/tutorial/discussion split (hours of each): N/A

Lecturer Details:
- Lecturer: Dr S. Krusch
- Lecturer home institution: University of Kent
- Lecturer e-mail: s.krusch@kent.ac.uk