GEOMETRIES DEFINED BY DIFFERENTIAL FORMS

Organizers:

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Aims: The subject of geometric structures on Riemannian manifolds is a very important, and intensely studied, subject in Differential Geometry. In particular, geometric structures such as contact geometry, symplectic geometry, calibrated geometry, and special holonomy geometries, are all defined by differential forms, and turn out to be very closely related to one another. Ever since the foundational work of Harvey and Lawson in 1982, the relationship between calibrated geometry and special holonomy has been of fundamental importance in Differential Geometry, as any $G-$invariant $p-$form on $\mathbb{R}^n$ induces a calibration on a connected Riemannian manifold (M^n, g) with holonomy $G \subset O(n)$. Moreover, recent directions in research show that there are manifolds that lie at the intersection of contact geometry and special holonomy, in particular G_2 and $Spin(7)$ holonomy manifolds, and that many ideas from both contact geometry and symplectic geometry have analogues to manifolds with special holonomy. Many of these objects have complexifications which are amenable to algebraic geometric techniques. In turn, real algebraic analogues provide a new frontier for research.

The cross-pollination of ideas from different areas of geometry takes roots in papers such as those of Fernandez and Gray from the 1960's wherein manifolds with special holonomy are treated as analogues of Kähler manifolds; moreover, because of the introduction in recent years of such powerful tools in symplectic and contact geometries such as Floer homology theories and its relatives, it is more important than ever to understand the connections between these fields as this will yield deeper results about manifolds with special holonomy and calibrated geometries than have been possible up to this point.

Our goal is to bring together a group of both junior and senior mathematicians who are experts in these different geometric structures in order to create a venue where they can interact and exchange ideas and developments, and to further the understanding of the relationships between these geometries, as well as the implications in gauge theory, (real) algebraic geometry, geometric PDE's, and mathematical physics.