Geometry And Physics 2014: Geometry and Supersymmetry

Summary of Event

The 2014 iteration of GAP was held at the Pacific Institute for Mathematical Sciences in Vancouver, BC from May 29-31, immediately preceding the String-Math summer school and the String-Math 2014 conference in Edmonton AB. This year, GAP consisted of a series of four mini courses on the topic of geometry and supersymmetry, given by Chris Brav (IAS), Ron Donagi (UPenn), José Figuero-O'Farill (Edinburgh) and Dan Waldram (Imperial). The conference was attended by 39 registered participants but also by the participants and organizers of the PIMS Undergraduate Workshop on Supersymmetry, held at about the same time.

Each of the lecturers explored an important topic at the intersection of geometry and physics which was intimately related to supersymmetry. Figueroa-O'Farill gave an overall review of supergravity theories, exploring the classification by examining the algebraic structure induced by the presence of special pseudo-Riemannian spinor fields. This approach brings an incredible clarity to a subject which is often plagued with confusing notation and case-dependent techniques. This course meshed extremely well with that of Dan Waldram, who focused on the new approach to supergravity theories through generalized geometry. In Waldram's talks, participants were exposed to the ability of generalized geometric structures to simplify the plethora of fields in supergravity theories and to express the theories as generalizations of Einstein-Hilbert gravity.

Ron Donagi used his lectures to explain his remarkable paper with Witten on the moduli space of supercurves, which after many decades finally explained that the moduli of supercurves does not simply project to the moduli of curves and so is a more subtle object than originally thought. His lectures were laced with a plethora of insights into classical algebraic geometry and were appreciated by students and researchers alike.

Chris Brav presented his recent work with Bussi and Joyce on shifted symplectic geometry, a subject which is, in a sense, familiar to physicists working on graded manifolds, but which has taken on an incredible new depth with the advent of derived algebraic geometry in the last decade. Brav explained how the analog of the Darboux theorem for shifted symplectic structures could be used to understand the geometry of the moduli space of sheaves on a Calabi-Yau 3-fold, making rigorous the considerations of holomorphic Chern-Simons theory which has guided the development of the subject for the past 15 years.

As in previous years, participation in the GAP conference included a full spectrum of researchers in physics and mathematics, including undergraduates, graduate students, postdocs and more senior researchers. We look forward to continuing the tradition of GAP, encouraging students and researchers at the interface of mathematics and physics to interact and understand each other's insights and methods.