Submittee: Karen Yeats
Date Submitted: 2014-09-04 12:14
Title: PIMS-SFU Undergraduate Summer School on Multiple Zeta Values
Event Type: Summer-School

Location:
SFU (PIMS SFU lecture hall and one of the computer labs)

Dates:
July 7 - August 1, 2014

Topic:
Multiple zeta values and their applications.

Methodology:
Primarily lectures and problem sessions. Some student presentations as well.

Objectives Achieved:
The students were exposed to some research level mathematics beginning only with a second year undergrad background. // They learned a lot and we heard from them that many were surprised how much they were able to understand. // Additionally PIMS and SFU now have additional exposure among some excellent undergraduates from across Canada and the US. //

Scientific Highlights:
To me the scientific highlight was how the undergrads, spontaneously in many cases, explored different aspects of the topic on their own.

Organizers:
Yeats, Karen, Mathematics, SFU //
Bruin, Nils, Mathematics, SFU //

Speakers:
Hoffman, Mike, Mathematics, USNA //
Lecture 1:
Title: The Lure of Multiple Zeta Values //
Abstract: In 1988 a colleague came to me with a conjecture about a certain type of multiple series. At the time I didn't suspect just how interesting these series are, and how they would profoundly affect the direction of my research. I couldn't prove the conjecture he showed me (which we called

the "sum conjecture"), but my attempts at it led to two other classes of identities. //
Lecture 2:
Title: The Depth Two Case //
Abstract: Double zeta values give a first playground for looking at relations before the complexities of general multiple zeta values. Tornheim sums are a useful tool. //
Lecture 3:
Title: The Algebraic Approach //
Abstract:
Given a two multiple zeta values (MZVs), one seeks to write their product as a sum of MZVs. Surprisingly, this can be done in two quite different ways: the shuffle and "stuffle" products. The two products come from the representation of MZVs both as iterated sums and as iterated integrals. //

Bruin, Nils, Mathematics, SFU //
Title: Lattice Basis reduction and short vectors (1 lecture) //
Abstract:
How can we try and let a computer try and find likely relations from numerical approximations? The LLL algorithm lets us attack such problems. //

Yeats, Karen, Mathematics, SFU //
Part 1: Graphs and Feynman graphs with a view to Feynman periods (5 lectures) //
Part 2: A MZV miscellany (3 lectures) //
Part 3: The state of the art (4 lectures) //
Abstract:
In part 1 I will set up what we need to think about how multiple zeta values show up in Feynman integrals, focusing on primitive log divergent graphs in scalar field theory. Along the way we will prove the matrix tree theorem with all preliminary details. In part 2 I will set us up to think about two big problems: the number of relations between multiple zeta values and how to predict the values of Feynman graphs using graph theory. In part 3 I will talk about what is the state of the art at reseach level in related areas. //

Lalin, Matilde, Mathematics, University of Montreal //
Title: Applications of multizeta values to Mahler measure (5 lectures) //
Abstract:
A short course exploring how Multiple Zeta Values arise naturally from some particular integrals, Mahler measures of polynomials. //

Links:
http://people.math.sfu.ca/~summerschool/

Comments / Miscellaneous:
Notes from lectures are available at the linked webstite (in the "program" section)
