Wednesday September 19th, 1pm P-131 Math Tower

Math Club

Abstract: The three stories below happened during one week in Berkeley where bill Thurston (1946-2012) was a graduate student. They illustrate the awe-inspiring impact meeting Thurston for the first time in a real math situation had on many of us. The math club talk will discuss the math related to the second story [curves on surfaces] and to a fourth story that occurred some years later. In that fourth story Thurston revealed how a toddler's play illuminates and gives new information about Riemann's conformal mapping theorem.

Stories about Bill Thurston and related mathematics

[First story] In December of 1971 a dynamics seminar was just ending in the Berkeley Math Department by algorithmically solving a thorny problem in the plane which had a nice application in dynamics. The solution purported to move N distinct points to any second set of epsilon near N distinct points by a motion which kept the points distinct and kept them always epsilon' near. After the applause, a graduate student in the back of the room stood up and said he thought the algorithm of the proof didn't work. He went shyly to the blackboard and drew two configurations of about seven points each and started applying to these the algorithmic method of the end of the lecture. Little paths started emerging and getting in the way of other emerging paths which to avoid collision had to get longer and longer. The algorithm didn't work at all for this quite involved reason. I had never seen such a comprehension of an algorithm and such a creative construction of a counterexample done so quickly. This combined with my awe at the sheer complexity of the geometry that emerged. I had never seen such deliberate geometric complexity, which was being imagined by said graduate student.

[Second Story]A couple of days later the grad students [in a confrontation with the university of California] invited me to join them in painting math frescoes on the wall leading to their offices. While milling around before painting the same grad student from story one came up to ask, "Is this interesting to paint?" He produced a drawing of a complicated smooth one-dimensional object encircling three points in the plane. I asked, "What is it?" and was astonished to hear "It is a single simple closed curve." "You bet it is interesting to paint. Let's do it." I said. So we proceeded to spend several hours painting this curve on the wall. It was a great learning experience because for such a curve to look good it has to be drawn in sections of short parallel slightly curved strands [like the charts

[Third story] That December I was visiting Berkeley from MIT to give a series of lectures on differential forms and the homotopy theory of manifolds and wanted to use the one forms that emerged from the construction. They described the lower central series of the fundamental group and I hoped they generated foliations and maps generalizing Abel's map to the torus associated with the first homology. I was new to ideas outside topology and I had asked all the differential geometers at MIT and Harvard about this possibility. However, I couldn't make myself understood. It was too vague or too algebraic. I presented the discussion to Bill Thurston, the graduate student, without much hope because the set up was quite algebraic. However the next day Bill came to me with a complete solution and a full explanation. It was elementary and involved actually understanding the basic geometric meaning of integrability and the Jacobi relation in the dual dd=0 form due to Elie Cartan.