William P. Thurston, Theoretical Mathematician, Dies at 65

by Manjil Saikia - Friday, August 24, 2012

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William P. Thurston, a mathematician who revolutionized understanding of the structure of three-dimensional spaces and won the Fields Medal, often described as the equivalent of the Nobel Prize for mathematics, died on Tuesday in Rochester. He was 65.

Thurston's geometrization conjecture states that compact 3-manifolds can be decomposed canonically into submanifolds that have geometric structures. The geometrization conjecture is an analogue for 3-manifolds of the uniformization theorem for surfaces. It was proposed by William Thurston (1982), and implies several other conjectures, such as the Poincaré conjecture and Thurston's elliptization conjecture.

Thurston's hyperbolization theorem implies that Haken manifolds satisfy the geometrization conjecture. Thurston announced a proof in the 1980s and since then several complete proofs have appeared in print.

Grigori Perelman sketched a proof of the full geometrization conjecture in 2003 using Ricci flow with surgery. There are now four different manuscripts (see below) with details of the proof. The Poincaré conjecture and the spherical space form conjecture are corollaries of the geometrization conjecture, although there are shorter proofs of the former that do not lead to the geometrization conjecture.

Thurston was born in Washington, D.C. to a homemaker and an aeronautical engineer. He received his bachelors degree from New College (now New College of Florida) in 1967. For his undergraduate thesis he developed an intuitionist foundation for topology. Following this, he earned a doctorate in mathematics from the University of California, Berkeley, in 1972. His Ph.D. advisor was Morris W. Hirsch and his dissertation was on *Foliations of Three-Manifolds which are Circle Bundles*.

After completing his Ph.D., he spent a year at the Institute for Advanced Study, then another year at MIT as Assistant Professor. In 1974, he was appointed Professor of Mathematics at Princeton University. In 1991, he returned to UC-Berkeley as Professor of Mathematics and in 1993 became Director of the Mathematical Sciences Research Institute. In 1996, he moved to University of California, Davis. In 2003, he moved again to become Professor of Mathematics at Cornell University.

In later years Thurston turned his attention to mathematical education and bringing mathematics to the general public. He has served as mathematics editor for Quantum Magazine, a youth science magazine, and as head of The Geometry Center. As director of Mathematical Sciences Research Institute from 1992 to 1997, he initiated a number of programs designed to increase awareness of mathematics among the public.

In 2005 Thurston won the first AMS Book Prize, for *Three-dimensional Geometry and Topology*. The prize "recognizes an outstanding research book that makes a seminal contribution to the research

literature".

In 2012 Thurston was awarded the Leroy P Steele Prize by the AMS for seminal contribution to research. The citation described his work as having "revolutionized 3-manifold theory".

He died on August 21, 2012 in Rochester, New York, of a melanoma that was diagnosed in 2011.

Thurston has an Erd?s number of 2.

John Milnor, co-director of the Institute for Mathematical Sciences at Stony Brook University on Long Island, acknowledged that Dr. Thurston delighted in working in a very esoteric realm. But he added that Dr. Thurston's work had made "a tremendous difference in the way we look at many problems."

Without that work, a Russian mathematician, Grisha Perelman, would not have been able in 2003 to solve the Poincaré conjecture, which asserts that the sphere is the only three-dimensional shape in which every loop in its structure can be shrunk to a single point, without ripping or tearing either the loop or the space. The problem had challenged mathematicians for 100 years.

In addition, cosmologists have drawn on Dr. Thurston's discoveries in their search for the shape of the universe.

On a more unlikely note, his musings about the possible shapes of the universe inspired the designer Issey Miyake's 2010 ready-to-wear collection, a colorful series of draped and asymmetrical forms. The fashion Web site Style.com reported that after the show, the house's designer and Dr. Thurston "wrapped themselves for the press in a long stretch of red tubing to make the point that something that looks random is actually (according to Thurston) 'beautiful geometry.' "

To his colleagues, Dr. Thurston's most unusual gift was his ability to visualize complex shapes and problems. They said he loved nothing more than to sit in a common room and help colleagues or students brainstorm on solutions to vexing issues. "He could look at a problem and see simplicity where nobody else could find it," said Jeff Weeks, a mathematician who studied with Dr. Thurston at Princeton.

We along with the world mathematical community deeply mourn the death of this mathematical genius. May his soul rest in eternal peace.

[Sources: Wikipedia and The New York Times]

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