Institute for Advanced Study

Seminars

The Geometry and Topology of the Freudenthal Magic Square

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Winner of Abel Prize and Fields Medal

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Abstract

The 4 classical division algebras (Real, complex quaternion, octonion) give rise to 4 projective planes. These explain the exceptional cases of Hopf invariant one in homotopy theory. But there is a "magic square" named after Frudenthal, which is a 4x4 symmetric matrix of spaces in which the projective planes form the first row or column and in which the dimensions go up as powers of 2, with the last corner having dimension 128. They are all homogeneous spaces of Lie groups with the 4 exceptional groups F_4, E_6, E_7, E_8 being those associated with the fourth row or column.

Recently an old problem in homotopy theory (the Kervaire invariant problem) has been solved and it is tempting to look at the magic square to explain the list of manifolds of Kervaire invariant 1. I will discuss how far this programmehas got.

About the Speaker

Sir Michael Atiyah is an Honorary Professor at Edinburgh University. He was previously a professor at Oxford and at the Institute for Advanced Study in Princeton. In the 1990's, he was Master of Trinity Cambridge, Director of the Isaac Newton Institute and President of the Royal Society. He was awarded the Fields Medal in 1966 and the Abel Prize in 2004. He is a foreign member of around 20 national academies and has over 30 honorary degrees. In 2005 he became President of the Royal Society of Edinburgh. He is a Visiting Member of the HKUST Institute for Advanced Study.