Università di Roma "Tor Vergata"
Villa Mondragone, June 30, 2016

Laurea Honoris Causa a

Vaughan Jones

Laudatio delivered by R. Longo

Mondragone for Mathematics and Physics
In 1611 Galileo went to Gianicolo and observed smallest details of Mondragone (20 km distant) with the telescope

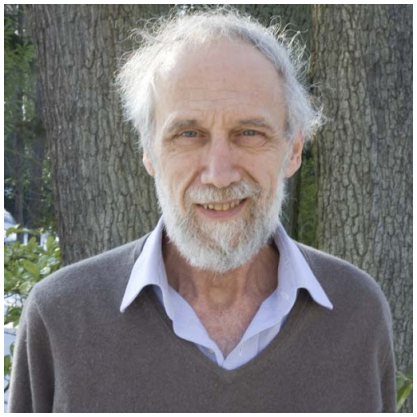
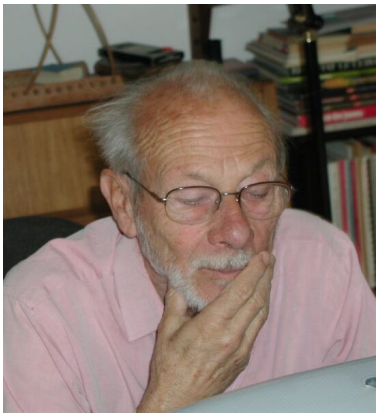
In this place Pope Gregorio XIII signed and proclaimed the papal Bull Inter Gravissimas, in 1582, giving birth to the new calendar, using the observations of C. Clavius and J. Kepler. An early example of *Mathematical Physics*.

A great scientist for Mathematics and Physics

In this place we are offering the Laurea Honoris Causa to *Vaughan Jones*, one of the greatest Mathematician of the last half century.

Early mathematical work

Sir Vaughan Frederick Randal Jones was born in New Zealand. He move to Switzerland for his graduate studies and completed his PhD at the University of Geneva in 1979. His thesis on "Actions of finite groups on the hyperfinite II_1 factor", was supervised by André Haefliger.

He was motivated by the desire to understand the infinite-dimensional mathematical structure provided by *Quantum Mechanics*, so hestudied the theory of *Operator Algebras* introduced by John von Neumann, that at that time was producing fundamental, deep results mainly due to Alain Connes.

The Jones Index (1983)

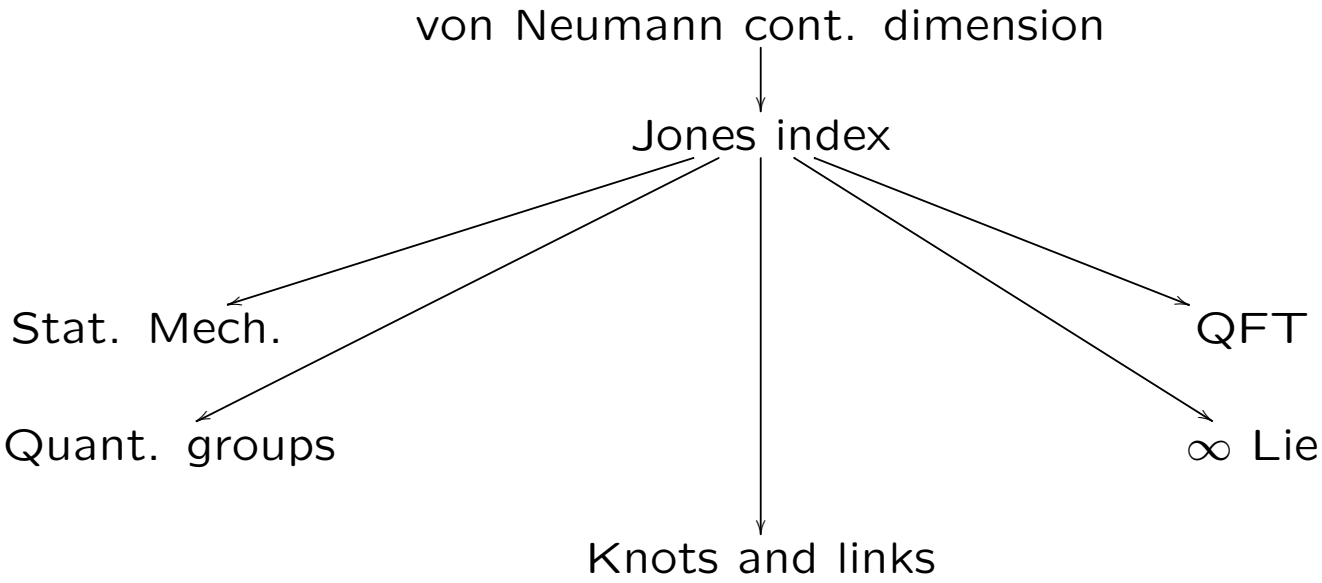
A factor M (*von Neumann algebra* with trivial center) is a highly infinite-dimensional object (e.g. an infinite matrix) that combines analytical, algebraic and order structures. If M has a trace, von Neumann continuous dimension tells us how M is realised by operators on a Hilbert space (quantum observables).

V. Jones introduced an *index* $[M : N]$ for a subfactor $N \subset M$. The surprising discovery was that the values of the index less than 4 are quantised:

$$[M : N] = 4\cos^2\frac{\pi}{n}\ , \quad n = 3, 4, 5, \ldots$$

The index is a possibly finite quantity that compares two infinite quantities.

The mystery of the appearance of these "strange numbers" produced an immediate intense research, a revolution in the Theory of Operator Algebras.



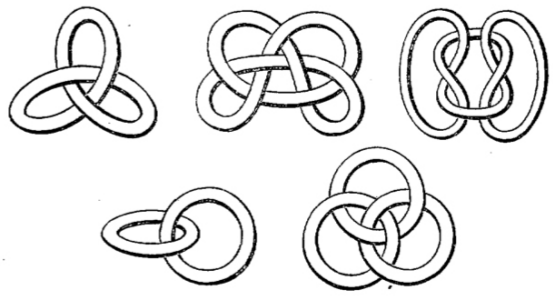
It is hard to find another mathematical discover with so much influence both in Mathematics and in Physics.

Jones polynomial (1985)

Working on the index of subfactor, Jones found an associated family of projections $p_1, p_2, \ldots$ with the Temperley-Lieb relations in Statistical Mechanics

$p_i p_{i\pm 1} p_i = [M : N]^{-1} p_i \ , \ p_i p_j = p_j p_i$ if $|i-j| \geq 2$

This led him to the construction of a new, powerful invariant for knots and links

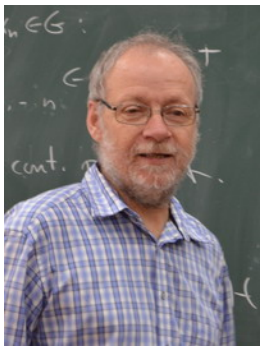


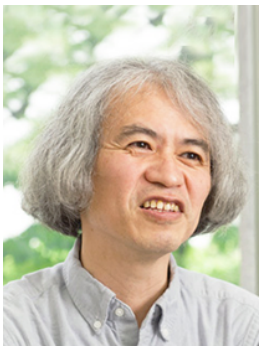
It is hard to decide whether two knots are the same, i.e. one can be deformed into the other, Jones polynomial is a polynomial *invariant* that does distinguish many knots. This completely new discovery gave new life to knot theory and soon entered in many different fields.

Classification of subfactors

The classification of finite depth subfactors initiate by Jones is a very deep result related to combinatorics in several areas of Mathematics. Early classification is due to Popa and Ocneanu

then by Haagerup, Izumi, Kawahigashi, Asaeda

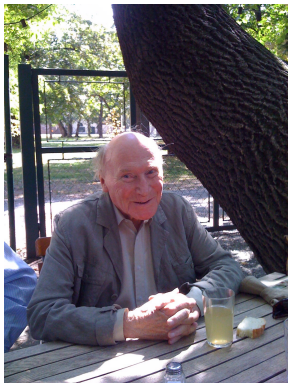




and many others... Still a very alive subject!

Quantum Field Theory. The Rome school

In the the late 60's Doplicher-Haag-Roberts made the celebrated work on superselection sectors, classifying (para-)Bose-Fermi particle statistics.


In 1988 I was personally involved in uncovering a close relation to Jones work

$$\text{DHR dimension} = \sqrt{\text{Jones index}}$$

A great deal of the research on Operator Algebras and Quantum Field Theory in Tor Vergata and other places worldwide continues to be based on Subfactor Theory.

Influence in low dimensional QFT and TQFT

V. Jones soon realised that his work had to be related to low dimensional QFT. Early collaboration with Wasserman.

Jones polynomial $\rightarrow$ *Witten's TQFT description*

Subfactors $\rightarrow$ *CFT, Kac-Moody algebras*

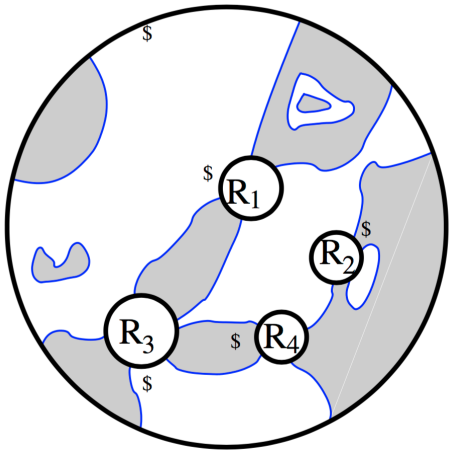
Froehlich, Fredenhagen, Rehren, Schroer, Guido, Kawahigashi, Evans, Xu, Carpi, Weiner, Bischoff, Tanimoto and many others...



Recent ideas of Jones point towards a deep subfactor realisation of CFT.

More recent work: Planar Algebra

Planar Algebra is a graphical way to describe Subfactors introduced by V. Jones



New subfactors have been recently produced by Jones' school by Planar Algebraic methods.

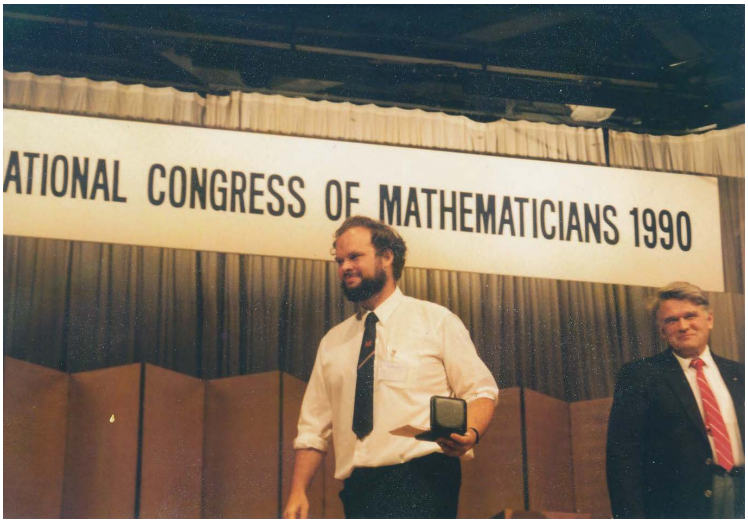
Subfactors are still producing an exciting interplay among Algebra, Analysis and Geometry.

Notable services

• Fellow of the Royal Society (1990)
• Miller Professor, University of California Berkeley (1992)

• Member of the US National Academy of Sciences (1999)
• Fellow of the American Mathematical Society (2009)
• Stevenson Distinguished Professor, Vanderbilt University (2011)
• Vice president of the International Mathematics Union (2014)

Notable awards



- Fields Medal (1990)
- Rutherford Medal by the Royal Society of New Zealand (1991)
- Onsager medal of Trondheim University (2000)
- Prix Mondial Nessim Habif (2007)

Off science. Knots and knots... passion!

Windsurfing...

kiteboarding...

Best wishes from all of us!