

Taming the monster

Computing aspects of a group whose size is a 54-digit number was the focus of Professor Robert Wilson's visit early in 2009. He talked with Jenny Rankine.

Affectionately called the Monster, this group has order $246 \cdot 320 \cdot 59 \cdot 76 \cdot 112 \cdot 133 \cdot 17 \cdot 19 \cdot 23 \cdot 29 \cdot 31 \cdot 41 \cdot 47 \cdot 59 \cdot 71$, which reads 80801742479451287588645990496171075700575436800000000.

Using a computer, Wilson earlier identified two 196882 by 196882 matrices that together generate the Monster group.

However, performing computer calculations with these matrices is extremely expensive in time and storage – the matrices alone take up five gigabytes of disc space.

Wilson has been working with NZIMA Maclaurin Fellow Eamonn O'Brien at the University of Auckland since an earlier visit in 2002, and is also collaborating with Associate Professor Jianbei An.

They are developing more sophisticated ways of doing computations with the Monster: "We can study the effect of the matrices using computer programs," says Wilson.

Wilson and his former PhD student, Beth Holmes, found that if V is a 196882 dimensional vector space over the field with two elements, and H is a large subgroup of the Monster in which it is easy to perform calculations, then elements of the Monster can be stored as words in the elements of H and an extra generator T .

This makes it reasonably quick to calculate the action of one of these words on a vector in V .

Most finite simple groups belong to families, but there are 26 sporadic individual groups that don't belong to families and the Monster is the biggest. "They're telling us something very specific about symmetry, but we don't understand exactly what it is," says Wilson.



"The sheer size of the Monster is a challenge to figure out what it's there for. We've made lots of progress classifying its maximal subgroups."

During his visit Wilson was also finishing a textbook on finite simple groups aimed at graduate students. This built on his work as a co-author in 1985 of the landmark Atlas of Finite Groups: Maximal Subgroups and Ordinary Characters for Simple Groups.

Wilson's former supervisor John Conway and their three other co-authors' six-letter surnames make a matrix on the cover.

Wilson is based at Queen Mary, University of London. Before his five years there, he lived in Birmingham and still plays viola and violin in the Sinfonia of Birmingham, an amateur orchestra with a professional leader.

He believes there is some truth in the maxim about the link between maths and music, but also says that both disciplines demand obsession and hours of practice.

"At the end of secondary school when I was learning calculus there were hundreds and hundreds of exercises with the variations, very like practicing scales. I didn't find it boring because I could do most of the exercises; it was a challenge to pit your wits against the next problem and try to beat it."

See also

Aspects of the Atlas of Finite Groups are online at <http://brauer.maths.qmul.ac.uk/Atlas/v3/>

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