Symmetry and Groups

23rd May 2015, Birkbeck

Programme

9:30 Registration and Coffee

10:00 Sarah Hart: 'Symmetry: before groups and after groups'.
Abstract: We will look at a few examples of how symmetry was studied pre algebra, remark on its cultural importance over time, and then give a brief roadmap of some of the main names that we will encounter through the rest of the day.

10:40 Peter Neumann: 'Sigola and permutations: there's little symmetry in Galois'.
Abstract: This contribution responds to a request for a talk on Galois and/or related topics. As the title indicates, it will involve Evariste Galois, symmetry and permutations. The focus will be more history of mathematics than mathematics itself.

11:30 Coffee

11:50 Norman Biggs: 'Coxeter and Conway on the Symmetry of Graphs and Maps'.
Abstract: In this talk I shall describe how the idea of symmetry was developed mathematically, particularly in the context of graphs and maps on surfaces. The key is the description of a group by means of generators and relations. H.S.M. Coxeter wrote many seminal papers on this subject, and his colleague W.T. Tutte obtained some remarkable results. In the 1960s this theory was rediscovered in unpublished work by J.H. Conway. He developed an approach that allowed the computational technique known as 'coset enumeration' to be applied, and this resulted in some beautiful examples of highly symmetric graphs.

12:40 Lunch

14:00 Mark Ronan: 'Les belles au bois dormant: Strange beauties hidden in the undergrowth'.
Abstract: This talk will discuss the discovery of the sporadic groups during the 1960s and 70s.

14:50 Rob Curtis: 'Sphere-packing, the Leech lattice and the Conway group'.
Abstract: What proportion of n-dimensional space can be filled by non-overlapping n-spheres all of the same size? This natural and innocent-sounding question is remarkably difficult to answer, even in low dimensions. However, if we restrict our attention to highly symmetrical arrangements of spheres known as lattice packings the problem becomes more tractable. In general there is no guarantee that lattice packings are optimal; but it turns out that in both 8 and 24 dimensions there are beautifully symmetrical arrangements of spheres based on the E_8 and Leech lattices which have been proven to be best possible. Both structures have large groups of symmetries, and in the latter case it is the Conway group $\cdot\mathbf{O}$. In this talk we explore sphere-packing in low dimensions, then briefly describe the E8 lattice before moving on to 24 dimensions. We conclude by showing how $\cdot\mathbf{O}$ can be obtained directly by considering a group with certain internal symmetries. The Leech lattice then emerges as a by-product.

15:40 Tea

16:00 Siobhan Roberts: 'Symmetries & Asymmetries, Coxeter & Conway'.
Abstract: Wherein the author "measures together" the mutual obsession with symmetry possessed by H.S.M. Coxeter and John Horton Conway, drawing from her experience in writing their respective biographies, *King of Infinite Space* (2006) and *Genius At Play* (2015).

17:00 End