Glorious symmetry

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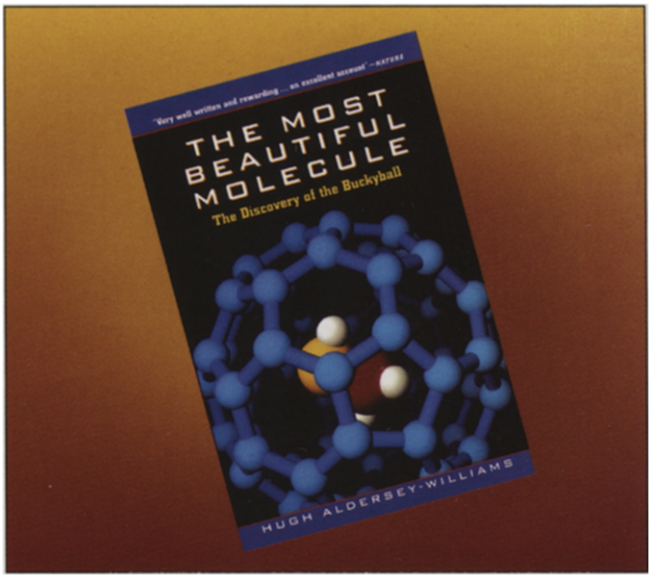
The Most Beautiful Molecule: The Discovery of the Buckyball by Hugh Aldersey-Williams, John Wiley & Sons, Inc. New York, 1995. 340 pp. $24.95 (hardcover) ISBN 0-471-10938-X

Prior to 1985, it was thought that the only forms of pure carbon that occurred in nature were diamond and graphite. However, during experiments on the mechanisms of formation of long chain carbon molecules in interstellar space and near stars, chemists Richard Smalley, of Rice University, and Harry Kroto, of the University of Sussex, discovered a remarkably stable cluster of carbons. The cluster was found to be composed of a single molecule containing 60 carbon atoms, C_{60}, and it had a highly symmetric, cage-like, spherical structure resembling the surface of a soccerball. Carbons formed the vertices, and covalent bonds between the carbons formed the edges, of a polyhedron containing 32 faces: 20 hexagons and 12 pentagons. The molecule was named 'buckminsterfullerene' in honor of the architect, Richard Buckminster Fuller, who popularized geodesic domes. Subsequent work by physicists Wolfgang Krätschmer, of the Max-Planck-Institute of Nuclear Physics, and Donald Huffman, of the University of Arizona, led to the development in 1990 of a method to produce macroscopic quantities of C_{60}, thereby facilitating the extensive investigations into its chemistry and applications that are currently in progress. The discovery of a third allotrope of carbon has created what is effectively a new sub-discipline within chemistry. Those who study C_{60} and its derivatives promise theoretical advances and practical applications in diverse areas, such as lubricants, superconductors, ferromagnets, catalysts and HIV protease inhibitors.

The Most Beautiful Molecule describes the discovery of C_{60}, and also the subsequent developments that led to verification of its structure and properties. The author successfully conveys the excitement that accompanies a major scientific discovery, in a style that is reminiscent of Jim Watson's 1968 classic, *The Double Helix* (although in this case the author was not involved in the events described) and for this reason alone the book is worth reading. The book is well written, with 61 illustrations, 40 pages of collected footnotes and an index.



The book appears to be intended for a general audience, but will be best appreciated by those who are familiar with a few basic concepts and techniques from organic chemistry. The author touches on many technical aspects associated with the field, including: molecular structure; atomic and molecular orbitals, and molecular orbital theory; sigma and pi bonding; hybridization; symmetry; chirality; single, double and triple bonds; conjugation; resonance; aromaticity; angle strain; chromatography; spectroscopy (UV, IR, and NMR); X-ray diffraction; host–guest complexes; organometallic complexes; photochemistry and superconductivity.

This book might be more useful if available in a less expensive paperback edition; it could then be a useful teaching aid for science courses, to be read in conjunction with the original paper by Kroto, Smalley and coworkers on the discovery of C_{60} (*Nature* (1985) **318**, 162–163), which is covered in detail in the book; Krätschmer, Huffman and colleagues' paper on the synthesis of macroscopic quantities of C_{60} (*Nature* (1990) **347**, 354–358); and a review article on the fullerenes (*Accounts Chem. Res.* (1992) **25**, 97–175). The publication of this book coincides with a PBS television broadcast of a NOVA documentary about the discovery of C_{60}; video cassette tapes of the program are also available from: Films for the Humanities and Sciences, Box 2053, Princeton, NJ 08544-2053, USA, Phone: 1 800 828 9424.