 Chemistry Elementary Jan 13th 2005 From The Economist print edition Evidence that superatoms exist could unsettle the periodic table THE periodic table of the elements is a comforting document. Within a few simple lines it manages to tame the seemingly chaotic world of matter into a reliable regularity. Each type of atom has its own pigeonhole, its place in the order of things. And the beauty of the periodic table is that the way it groups atoms allows some prediction of how they should behave. The noble gases such as helium remain aloof and unreactive, while the alkali metals can be expected to be silvery and reactive. Such certainties are now being questioned by work showing that special clusters of atoms behave in unexpected ways. Research published in this weeks Science, by Shiv Khanna of Virginia Commonwealth University, Welford Castleman of Pennsylvania State University and their colleagues, has found that some unusual clusters of atoms behave like single atoms of other elements. A cluster of 13 atoms of aluminium, for example, was found to behave as though it is a single atom of the halogen group, which includes chlorine and iodine. "Superatoms", as the researchers dub them, are a surprising and fascinating finding for chemists. Monoelemental clusters are already known. One of the most famous is buckminsterfullerene, a soccerball-shaped structure composed of 60 carbon atoms which is sometimes referred to as the buckyball

, and which was discovered by Sir Harry Kroto, now a professor of chemistry at Florida State University. However, buckyballs are different from superatoms as they do not pretend to be another element entirely. The chemists behind the suggestion of superatoms do not yet completely understand how and why these structures form, but the key to their behaviour is that they mimic the way that the electrons of another atom would present themselves to the world. The best candidates for making superatoms, therefore, are elements that are able to form very stable structures in clusters of a certain number of atoms, and that share their electrons easily. At the moment, the team has only positively identified clusters of 13 and 14 aluminium atoms as superatoms. One of the most important points about superatoms is that they are able to react with other elements and form entirely new chemicals. In one example, the researchers reacted a superatom of aluminium that mimicked members of the alkaline earth group (calcium and magnesium, for example) with iodine. The combined structure had a unique new chemistry, so it seems likely that superatoms might form the basis of new families of chemicals. It is too early to be sure what the long-term significance of this will be. One possibility is that it is just an intriguing but obscure wrinkle. On the other hand, it may be that a small window has been opened that looks on to an entirely new field: superatom chemistry. And if this is the case, there may be a new kind of periodic table waiting to be discovered. Perhaps the flat and two-dimensional periodic table of the elements, known since 1869, needs another, third dimension. Things might not be

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