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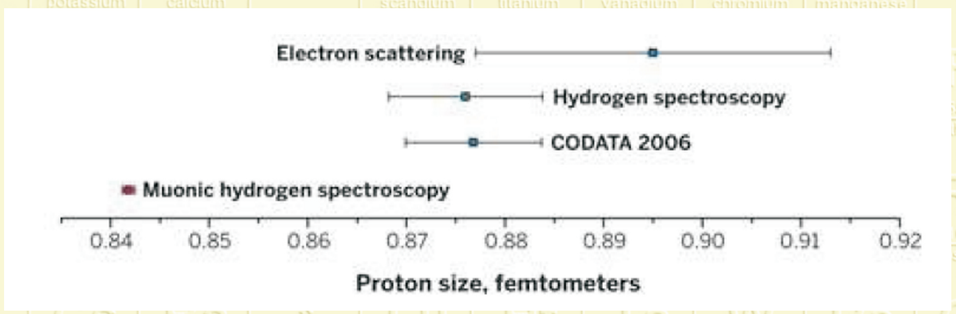
El protó, més petit encara

A new experiment indicates that the proton may be significantly smaller than previously believed, a result that could change the value of key physical constants, reports a group led by physicist Randolf Pohl of the Max Planck Institute for Quantum Optics, in Germany *(Nature,* **2010**, *466*, 213).

The group studied muonic hydrogen, in which the hydrogen atom's usual electron is replaced with a muon, a particle that has the same charge but is 200 times heavier than an electron. The researchers used laser pulses to probe the energy difference between two states of the atom and then used that difference to calculate the proton's charge radius, a measure of the spread of its positive charge.

From the muonic hydrogen experiment, Pohl and coworkers found that the charge radius of the proton is 0.84184 femtometers. That radius differs significantly from the previously accepted value of 0.8768 fm, which the International Council for Science's Committee on Data for Science & Technology (CODATA) settled on in 2006 after reviewing results from experiments involving the scattering of electrons off protons and the spectroscopy of atomic hydrogen.

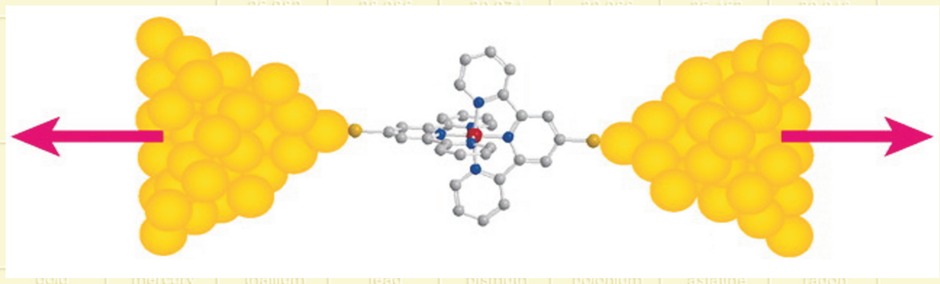


Estiraments i magnetisme

The mechanical stretching of a single cobalt complex tethered between two gold electrodes alters the molecule's magnetic states, changing the processes by which electrons flow through the system (J. J. Parks, et al. *Science,* **2010,** *328,* 1370).

This strategy, developed by physics professor Daniel C. Ralph and postdoc Joshua J. Parks of Cornell University, and their colleagues, not only gives scientists an ideal tool for investigating subtle details of molecular magnetism but could also provide a way to control molecular spin states for applications such as information storage. The group connected an octahedrally symmetric cobalt complex to two gold electrodes. In its normal state, the complex has a cubic shape. They then stretched the complex, distorting it into a tetragon. When the molecule's symmetry is broken, formerly degenerate spin states separate into discrete levels, which can be observed in spectral lines.

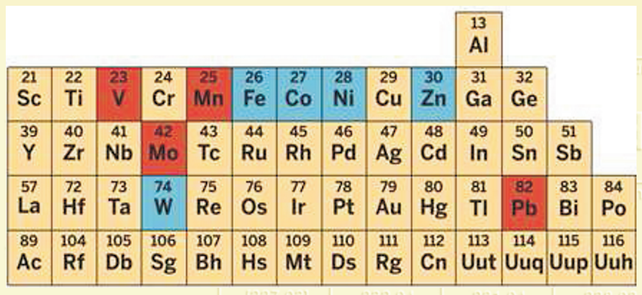
This new level of mechanical control over the spin states allowed the group to study a complex, spin-dependent phenomenon known as the Kondo effect, in which the molecule interacts with neighboring conduction electrons.



Més metalls biològics

Metalloproteins may be more numerous and diverse than previously suspected, researchers report (A. Cvetkovic, et al. *Nature,* **2010** *,466,* 779).

Proteins often use metals as cofactors and catalysts, but predicting which proteins incorporate which metals is difficult because of the variety of metal-binding sites found in proteins. The challenge is an important one because nearly half of the structurally characterized enzymes in the Protein Data Bank need metals, yet it is not possible to predict with certainty which proteins will use which metals. Indeed, most metals associated with proteins are discovered "after the fact" as people study particular proteins, says study leader Michael W. W. Adams of the University of Georgia, "We used the reverse approach," he says. "Rather than purifying proteins and seeing what metals they contain, we purified metal peaks and then tried to see what proteins were associated with the metal."

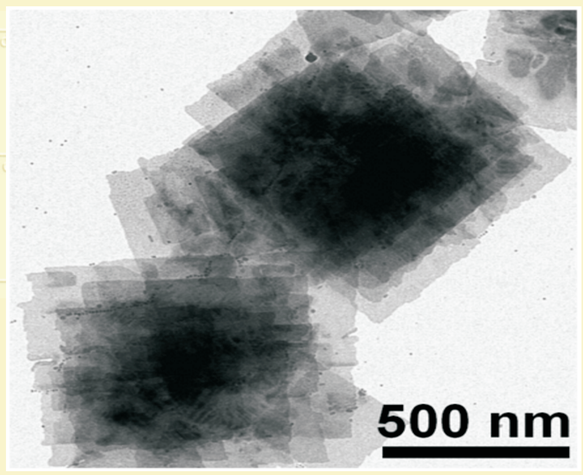


Ten metals (out of 18 selected) were found to be part of unidentified metalloproteins in the microbe *Pyrococcus furiosus.* Those highlighted in blue were shown to be used by the organism, whereas those in red (plus uranium, not shown) were preiviously unknown.

El solvent modifica la forma

By adding a chloroalkane cosolvent to the standard procedure for preparing lead sulfide nanocrystals, chemists have shifted the shape the crystals take from spheres to ultrathin sheets (C. Schliehe, et al. *Science,* **2010,** *329,* 550). The quality of the resulting sheets, which are several hundred nanometers across but only a few nanometers thick, is so high that the material can be integrated into a photodetector without any further processing.

The research comes from a group led by Horst Weller of the University of Hamburg, in Germany. According to the researchers, the chlorinated solvent encourages two-dimensional sheet growth over 3-D particle formation by slowing down the PbS growth rate during primary nanocrystal formation. This process, in turn, exposes highly reactive facets on the growing crystal surface that act as fusing points for other nanocrystals. A layer of oleic acid—an organic ligand used in the nanoparticle synthesis—forms on the sheet's surfaces, driving the 2-D growth. This so-called oriented attachment of nanocrystal building blocks "is one of the most promising approaches in nanotechnology," the researchers note.



Breus

• Els deu campus de la Universitat de Califòrnia han decidit fer boicot a la revista *Nature,* degut a l'increment del preu de la subscripció. (*Chem. Eng. News*, 14 de juny de 2010)

•Investigadors del Museu del Louvre han desvetllat, finalment, les bases del sfumato, tècnica que Leonardo emprà en molts dels seus quadres, com a La Gioconda. (*Angew. Chem. Int. Ed,.* **2010,** *49,* 6125).

•L'estructura cristal·lina d'un derivat del ciclobutadiè ha confirmat la seva geometria quadrada. *(Science,* **2010,** *329,* 299).

Avui recomanem

El llibre que Norman Foster ha publicat sobre un cotxe dissenyat per l'arquitecte canadenc Richard Buckmisnter Fuller (1895-1983), que donà nom als ful·lerens.
Buckminster Fuller. Dymaxion Car. (Ivorypress, 2010. 223 pàgines. 59.90€)

L'element

L'element número **51**, **antimoni**, és conegut des de l'antiguitat i s'hi troben referències a l'Antic Testament; els egipcis ja feien servir l'estibina (Sb_2S_3) com a cosmètic per enfosquir els ulls. L'origen del nom és incert, els grecs n'hi deien *anthemoniun,* que deriva de l'arab *al ithmid*, que vol dir màscara, en referència al seu ús com a cosmètic. L'alquímia li assignà un símbol i s'estudiava com a possible reactiu en la transformació de metalls en or. És el primer element que tingué una monografia apareguda el 1575, «*De secretis antimonii*», d'Alexandre von Suchten.

Presenta diverses formes al·lotròpiques i l'estable, α-Sb, té una estructura pròxima a la dels elements metàl·lics. S'obté per reducció del Sb_2S_3 amb ferralla. Tradicionalment, s'ha emprat en medicina com a emètic i en tractaments de malalties tropicals, però el caràcter tòxic de la major part dels seus compostos – que produeixen uns efectes molt semblants al de l'arsènic– en limita el seu us. Altres aplicacions actuals estan relacionades amb la fabricació de semiconductors. en aliatges que augmenten la resistència a la fricció i en materials retardants de flama.