Expect the unexpected

The announcement of this year's Ig Nobel Prizes, for "achievements that make people laugh, and then make them think", included one for physicists Lakshminarayanan Mahadevan of Harvard University and Enrique Cerda Villablanca of the Universidad de Santiago de Chile, who won the award for studying how thin elastic sheets become wrinkled. That doesn't sound strange to a physicist, but presumably it does to the general public. The Ig Nobels amuse because they catch scientists studying what seems to be ridiculous, although it often turns out to be entirely sensible — knowledge or capability in one area of science is almost always important in others, sometimes in the most unexpected ways.

A nice illustration comes from recent experiments on microfractures in crystals, more sensitive than previous ones by several orders of magnitude, and capable of measuring events that release only a few femtojoules — equivalent to the breaking of a few hundred bonds. Naively, one might suppose that such a huge advance resulted from a focused effort on that specific goal, yet the truth is rather different.

Deep within the Gran Sasso underground laboratory in Italy, the European CRESST research team is trying to detect weakly interacting massive particles (WIMPS), which might make up some of the dark matter that numerous cosmological anomalies suggest may exist. This requires extremely sensitive detectors, well isolated from noise and perturbing cosmic rays. The CRESST team uses crystalline detectors, coated with a thin film of tungsten and working near 15 mK, at the boundary between the film's superconducting and normal states. A tiny change in the film's temperature — triggered by energy deposited by an absorbed particle — will cause a much larger change in its resistance, which can be measured using a SQUID.

In preliminary experiments, researchers found spurious signals, bursts of energy with signatures unlike those expected for WIMPS. However, the researchers realized later that they were seeing traces of microfracture events in sapphire crystals within the bearings supporting the device. They learned how to fix that problem, but also had the good sense to recognize that, almost by accident, they had created an exceptionally powerful tool for studying the fracture

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dynamics of single crystals. It's as if astronomers had built an immense telescope to glimpse distant galaxies, and then found it to be the world's most sensitive microscope.

Data collected so far reveal striking similarities between the microfracture process in perfect crystals and fracture dynamics in far messier settings such as the Earth's crust (http://arXiv.org/abs/0708.4315v2). For one thing, the distribution of fracture events with energy released follows the Gutenberg–Richter law of earthquake science, with the number of events releasing energy E being closely proportional to $1/E^2$. The similarity also extends to the time domain: microfractures cluster much as earthquakes do, revealing a power-law distribution of waiting times between events.

These findings aren't especially surprising — more striking is the extension of these dynamical similarities over an impressive thirty orders of magnitude in energy, from crystalline microfractures up to the largest earthquakes. Also not surprising, perhaps, is that the researchers didn't set out specifically to do it, but just tackled one small puzzle after the next.

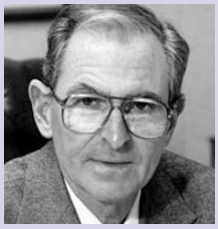
Mark Buchanan

OPEC accepts no substitute

At the time of the invasion of Iraq, the reasons given for it seemed unconvincing; they are even less convincing now. Even the Bush administration can't have believed that the pathetic remains of Saddam Hussein's regime posed a serious threat to the United States, or that the secular Ba'athists were somehow hooked up with the religious fanatics of al Qaeda.

Clearly, one motivation was the missionary zeal of the neoconservatives who dominate the US administration and seek to impose American-style ideals whether the world wants them or not. Another is that, as long as Saddam remained a threat to Israel and the rest of the region, we had to keep large numbers of troops in Saudi Arabia and Kuwait — an irritant that may have been the motive for the 9/11 attacks. And of course, we have deposed a real monster who committed unspeakable crimes against his own people.

For decades, it has been the explicit policy of OPEC to keep the price of oil within certain limits: not too low, of course, to preserve revenue; but also not too high, because that would encourage investment in alternative fuels. The implicit threat is this: if you put money into developing an alternative to oil, we will open the spigot, flood the market with cheap oil and wipe out your



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investment. In other words, the war with Iraq may also have been about preventing investment in alternative fuels.

OPEC's policy is not based on hard-headed reality, but on naive belief in a foolish theory. Our society is firmly rooted in the myth of an endless supply of cheap oil. The theory is that when the oil does start to run out its price will go up, and a cheaper substitute will appear, magically. We may have gone to war to prevent that from happening, but it won't happen because it can't. There is no substitute for the cheap oil that runs our civilization.

David Goodstein