

Are accelerators dangerous?

A new book by a US judge rehashes the claim that accelerators could destroy the universe. Although his arguments sound ludicrous, physicists must study them, says **Robert P Crease**

Richard Posner is a US federal judge and lecturer at the University of Chicago Law School. In his latest book *Catastrophe: Risk and Response*, he says that particle accelerators are not worth the risk. A non-zero possibility exists, he writes, that they will create a “strangelet” particle that will destroy the planet. Posner’s arguments apply most immediately to the Relativistic Heavy Ion Collider (RHIC) at the Brookhaven National Laboratory in the US, to a planned upgrade to the facility called RHIC-II and to CERN’s Large Hadron Collider, which opens in two years’ time.

Physicists need to study Posner’s views carefully, but not for his insights into the risk of accelerators. His remarks instead reveal much about how opinions about the safety of scientific projects are formed.

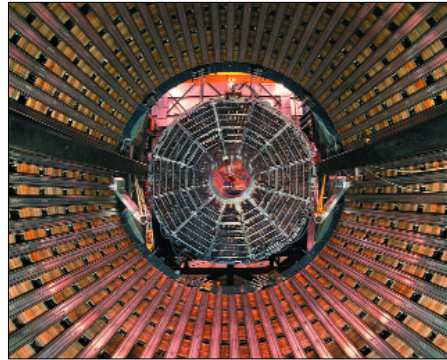
Strangelets, again

Strangelets – postulated lumps of stable matter containing many strange quarks that can absorb normal matter – have never been seen. Before RHIC came online in 1999, the lab’s then director asked four scientists to report on the dangers of strangelets. They concluded that the probability of strangelets being produced – if they exist at all – is almost infinitesimally small (*Physics World* July 2000 pp19–20).

Posner carries out a cost–benefit analysis. We know that RHIC cost \$600m to build and will require \$130m a year to operate for 10 years. Posner then takes a “wild guess” that its benefits are worth \$250m per year, which is \$2.5bn over its lifetime. Discounting – i.e. converting future values into present ones – at 3% puts RHIC’s total benefits over 10 years at \$2.1bn.

Posner then estimates the “cost of extinction of the human race” at \$600 trillion [i.e. $\$6 \times 10^{14}$]. Assuming that the annual probability of a strangelet disaster is one in 10 million, RHIC has an annual expected extinction cost of \$60m. Adding on the annual running costs gives \$190m, which – when discounted at 3% – yields \$1.6bn over 10 years. He then adds on the \$600m construction costs to give \$2.2bn. RHIC’s costs then outweigh the benefits by \$100m.

The judge admits that it is difficult to estimate each term of this calculation: the social benefits of the basic research of the kind RHIC does, the social cost of a disaster and the probability. Still, this does not mean the risk is subjective. “Doomsday risks, though involving very slight probabilities, could doom many projects,” he concludes.



Worth the risk? – the Relativistic Heavy Ion Collider.

But false doomsday-risk estimates may panic people into nonsensical actions. And his use of probability is ultimately illogical. There is an important difference between infinitesimal “real probabilities”, such as winning the lottery, and infinitesimal “false probabilities” involving things that are almost surely impossible, such as cats breathing gas fumes and changing into dragons.

Posner is recycling arguments advanced two years ago by the astronomer Sir Martin Rees in his book *Our Final Hour*. Posner’s main contribution is to dramatize the argument by couching it in terms of that great contract killer of thinking: money.

The writer Norman Mailer coined the word “factoid”, using the suffix “-oid” to mean resembling, but not the real thing. Today, however, the word is often used to mean a trivial or insignificant fact. But in Mailer’s original sense, a factoid was something manufactured by other needs.

In a similar spirit, I would like to coin the word “doxoid”. It is formed by attaching the same suffix to *doxa*, which is the ancient Greek word for opinion or belief. A doxoid looks like an opinion or belief, for it is a firmly held expression involving the affirmation or rejection of something in a way that seems to be justified by evidence. But unlike an opinion or belief, a doxoid has not been independently thought out. Instead it is a product of other beliefs and opinions.

A doxoid is like the spin of an atom in a ferromagnetic lattice: it points firmly in a certain direction, but not due to any intrinsic orientation. It is instead a function of the forces arising from other spins around it.

Posner’s position about accelerators is a doxoid. It is a function of the fear of large-scale calamities, the desire to ward off danger above all else, the distrust of arguments that one cannot understand and the distrust of scientists as a government-supported elite

corps of experts.

But unless you are one of the four authors of the 1999 paper, or among the handful of others competent to evaluate it, your position on the subject, too, is a doxoid. The surrounding forces shaping your position include your knowledge of physics, what and whom you have found to be reliable, and so forth. Your opinion, like that of Posner, is a function of that vast interstitial domain where science and society are interwoven.

Posner’s work ultimately does not aim to shed light on the risk of accelerators. As the anthropologist Clifford Geertz noted recently in the *New York Review of Books*, Posner is engaged in “engineering a social mood... out to alter attitudes, redirect mind-sets, re-focus worries; transform the currents of popular feeling”.

As a prominent public intellectual, Posner exerts a force that will surely shape other opinions. His book, for instance, has received enthusiastic reviews that appear to endorse his anti-accelerator arguments in periodicals as diverse as the Harvard University campus newspaper and *Science* (307 1205).

The critical point

The evidence behind certain fervently held beliefs – fearing tiny amounts of radiation, for instance – is often so slender that scientists may assume the believers to be guilty of ignorance, irrationality or cynical posturing. This is a dangerous assumption, for it promotes ineffective ways of coping. One is to pretend that it is an aberration – that the spins in question are isolated and that interatomic forces will ultimately prevail. Another is to dream that the public will acquire the appropriate level of scientific education – that each spin will end up pointing the right way by itself.

These are forms of magical thinking. A scientific approach would not only continue to examine the thing feared, but would also examine the forces governing the process by which non-scientists arrive at judgments about scientific issues. This would maximize the ability of science to help humanity deal with what threatens it. Losing track of this, and ceasing inquiry into the world out of fear, ultimately will entail losing our ability to figure out what is truly fearful and what is only a figment.

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