

ALSO BY CHARLES SEIFE

Decoding the Universe

Alpha & Omega

Zero

SUN IN A BOTTLE

The STRANGE HISTORY of FUSION
and the SCIENCE of WISHFUL THINKING

Charles Seife

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more recent predictions. They claim to have experiments that back up the computer code, but it is impossible to tell, from the outside, whether they are telling the truth. The evidence they cite, like the LASNEX code itself, is classified.

Beginning in the late 1970s and extending until the late 1980s, the national laboratories at Los Alamos and Livermore embarked on a classified program of experiments dubbed Halite/Centurion. These experiments were intended to help the laser fusion community test LASNEX and improve the code, and to determine, once and for all, the conditions required to ignite a fusion reaction in a pellet of deuterium. Instead of using lasers to ignite a pellet, the Halite/Centurion program used nuclear bombs.

Though very little information is available about the Halite/Centurion experiments, some details have dribbled out. It appears that the tests used hohlraums—the little metal tubes that are crucial to indirect-drive laser fusion—containing target pellets. These hohlraums and pellets were placed deep underground, at various distances from nuclear bombs. When the bombs went off, they radiated x-rays in all directions. Some of those x-rays shined into the hohlraums, which reradiated x-rays toward the pellet, just as in a laser fusion experiment. These reradiated x-rays, in turn, crushed the deuterium pellets, and scientists observed the resultant fusion reactions.

Laser fusion scientists state that the Halite/Centurion tests were a ringing confirmation of their beliefs and of LASNEX's predictions. They claim that the tests put to rest questions about the feasibility of laser fusion reactors—though they don't give any details. If the pro-laser-fusion scientists are to be believed, then Halite/Centurion showed that the laser fusion program is on the right track.

Not everybody agrees. Apparently, the hohlraums in the Halite/Centurion experiments received varying amounts of energy, from tens to hundreds of millions of joules, about a thousand times greater than the energy even the Nova laser would deliver. But even with that much energy driving them, 80 percent of the capsules failed to ignite, says Leo Mascheroni, a former Los Alamos laser physicist. Worse yet, he says, LASNEX didn't predict the failures. Mascheroni argues that the pro-

laser-fusion lobby is hiding negative results behind a wall of secrecy; if outside scientists could see the data, he says, they would conclude that Halite/Centurion proved that the laser fusion program was failing miserably.

Who is correct? It's a secret. Those scientists who have access to the data from Halite/Centurion can't talk; it's unlawful for them to make any details public. Those who don't have access obviously can't assess the arguments. It's the big secret of laser fusion. Only the scientists working on laser fusion can see the proof that they are on the right track. Those of us on the outside are forced to take their word for it. And for the past few decades, their word hasn't been very good at all.

Magnetic fusion has the advantage of openness. You can read almost all the literature that has been written about it. You can visit the facilities and walk around without fear of stumbling into a classified area. Indeed, by the 1990s some fusion labs looked as if they were desperate for visitors.

It was a far cry from the golden age of fusion. Twenty years earlier, in the mid-1970s, fusion had plenty of support from Congress and from the public.* The OPEC crisis had sent fusion budgets soaring, and scientists planned large magnetic fusion machines around the country. Most of them were tokamaks, but a few other designs were also planned, such as a mirror-type machine at Livermore.

The big tokamak in the United States would be at Princeton: the Tokamak Fusion Test Reactor (TFTR), which promised to achieve breakeven. TFTR was supposed to cost a bit more than \$300 million,

* Some of the support was unwanted. The conspiracy theorist and presidential candidate Lyndon LaRouche was a big supporter of fusion power, and founded an organization, the Fusion Energy Foundation, to support the cause. According to LaRouche's *Executive Intelligence Review*, the foundation was shut down in the late 1980s after a long campaign of harassment by British and Israeli intelligence operatives. According to most other sources, the foundation was shut down when the government went after LaRouche for mail fraud. (He was convicted in 1988.)