

Proton decay search: A result of GUTS

In traditional physics the basis of the stability of matter is the proton. There is a principle called "conservation of baryons," which says that if a particle of the class called baryon decays radioactively, another particle of the baryon class must be among the decay products. Baryons decay merrily down the scale of mass until they reach the proton. There is no lighter baryon than the proton, so it can't decay. Protons are stable and so is the material world built out of them.

Not any more. The theorists who are trying to unite all of physics into a single "grand unified field theory" (GUTS) perceive that the next step in their unification procedure cancels conservation of baryons and predicts proton decay. So seriously is this development taken that the Department of Energy is now on the point of funding two large experiments dedicated to a search for proton decay. Two are necessary, says David B. Cline of the University of Wisconsin at Madison, a participant in one of them, so that physicists are properly convinced if this revolutionary decay is actually found. One group includes physicists from Wisconsin, Harvard, Purdue and the University of Minnesota. Principal investigators are Cline, Carlo Rubbia of Harvard, Marvin L. Marshak of Minnesota and James Gaidos of Purdue. The second group is a collaboration of the University of California at Irvine

and the University of Michigan, with Frederick Reines of Irvine and John Vander Velde of Michigan as "spokesmen."

Both groups plan variations on the same idea. A large volume of water is the arena for proton decays. Water makes it easy to record the decay and to observe the decay products, Cline says. The water will be surrounded by arrays of detectors, different ones in each case. ("The DOE was particularly concerned that our detectors should be different from theirs," Cline says.) Cline's group will bury 1,000 tons of water in a mine in Park City, Utah. The Michigan-Irvine group will put 2,000 tons in a salt mine in Ohio.

Burial is necessary for shielding. Proton decays should still be extremely rare. The underlying interaction that unifies electromagnetic forces and the strong and weak nuclear forces can change baryons to leptons, the parallel and until now separate family of particles, but in the specific case, the quarks that make up a proton will change to an electron and a positron, say, only when they are close together. In a proton the quarks spend most of their time far apart (by their standards). Lacking a means for physical compression of a proton, physicists can only wait till chance brings the quarks together and a decay occurs. Present calculation is that the proton should have a half life of around 10^{30} years. These volumes of water and a few years' waiting time ought to show something if that number is correct. If they do, they will not only support the grand unification theories, they will provide a whole new laboratory for studying them. □

Mexico's endless spill: An ocean of oil

The runaway Mexican oil well, heralded last August as the worst spill in history, continues to gush up precious crude at the rate of about 5,000 barrels per day (SN: 8/11/79, p. 99). A relief well completed two weeks ago has been injecting water into the oil well at a rate of 40 to 120 barrels per minute, unsuccessfully trying to block the oil flow so that a plug can be cemented in to cap the damaged well. Hope now rests with a second relief well that could intersect the oil conduit by Christmas.

So far, damage from oil reaching Texas has been "minimal." Barrier islands along the Gulf Coast withstood the assault and protected the more ecologically sensitive estuaries. And since September, a reversal in Gulf currents has directed oil toward Mexico's Yucatan Peninsula. But if the spill is not halted by January or February, when the current again turns north, Texas may be in for more.

Below: Texas beach after being hit by Mexican tar balls last August.



Carter acts on TMI: A flood of changes

President Jimmy Carter announced plans last week to implement virtually all of the recommendations contained in the report of the Kemeny Commission, an investigatory panel he established earlier this year to look into the March 28 accident at the Three Mile Island nuclear plant.

The Kemeny report (SN: 11/3/79, p. 309), issued five weeks earlier, found serious deficiencies in the way that both the government and the utility industry regulate and manage nuclear power. "I agree fully with the spirit and intent of the Kemeny Commission's recommendations," Carter said last week, adding that he would carry out those within his power to implement and would ask "relevant government agencies to implement virtually all of the other recommendations."

Among immediate moves Carter announced December 7 were:

- Temporary substitution of John Aherne, a current member of the Nuclear Regulatory Commission, as chairman of the agency. Former chairman Joseph Hendrie, who was not asked to leave, will continue to serve as one of the NRC's five commissioners. Later, as a seat becomes open—either by retirement or by the term expiration of Commissioner Richard T. Kennedy next June—a new chairman will be appointed from outside the agency.

- Strengthening of the role of the NRC chairman, giving that person the power "to act on a daily basis as the chief executive officer." Carter, claiming that the chairman must be able to act on behalf of the agency during emergencies, would grant the chairman authority to put needed safety requirements and procedures in place and would give that person power to select key personnel. Carter said legislation to reorganize the NRC would be forwarded to Congress the first of next year.

- The direction of the Federal Emergency Management Agency to take control of emergency activities, such as evacuations, occurring off a powerplant's site. FEMA will also be required to review by June all state emergency plans.

- The direction of NRC and other agencies to speed placement of a resident federal inspector at every reactor site.

- Plans to establish a five-member "expert advisory committee" to keep the President and the public apprised of the progress by federal agencies, the states and the nuclear industry in improving reactor safety and implementing Kemeny Commission recommendations.

Carter's proposal to enhance the NRC chairman's executive powers comes in response to the Kemeny Commission's charge that confusion dominating the government's efforts to assess the severity of the accident and to coordinate emergency action was fostered by the fact that