

has never actually been seen before. The theoretically calculated probability of pionium's appearance is one chance in ten million. The experiment found 21 candidates for pionium (about one for every ten hours of running time) among many millions of K-meson decays. The experimental probability is now being calculated to see if it agrees with theory.

Schwartz and his group plan further pionium experiments at Brookhaven, and it is virtually certain that other physicists and laboratories will soon get into the study of the new quasi-atom. □

Californians reject nuclear moratorium

By a nearly two-to-one margin, Californians resoundingly defeated Proposition 15 on their June 8 ballots, an initiative that would essentially have brought about a moratorium on nuclear energy in the state (SN: 5/22/76, p. 324). Anti-nuclear groups, however, are still hoping to enter similar propositions on the ballots of other states that permit such initiatives. Moreover, three new laws have been signed in California that may keep the nuclear debate there alive for some time.

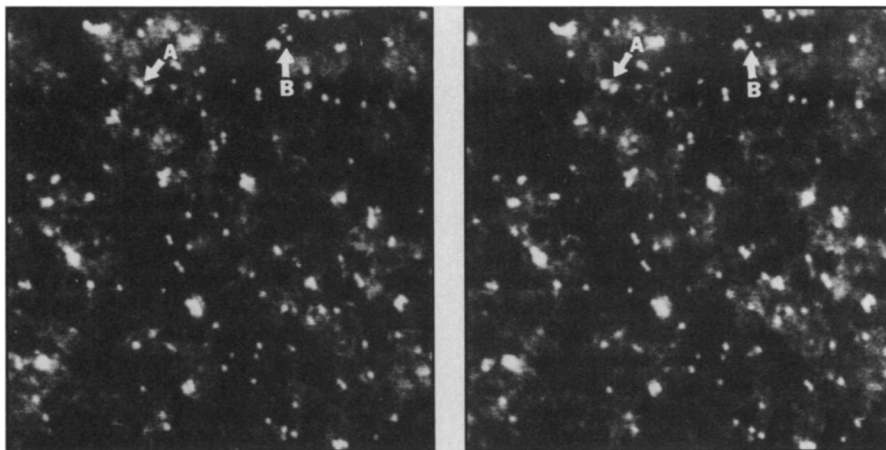
The defeated proposition would have permitted no nuclear plants—including those in operation—to be licensed in the state unless the federal liability limitations were changed and unless the state legislature agreed to the adequacy of certain safety features by a two-thirds majority.

The new laws, signed by Governor Edmund G. Brown Jr. on June 3, will permit the continued operation of the three reactors already licensed, as well as construction of several others already planned. But siting of new nuclear installations would not be permitted until the federal government had provided a permanent storage facility for high-level nuclear wastes and had licensed a fuel reprocessing plant, and until a feasibility study of placing reactors underground had been completed.

Such state laws requiring federal action before a federally regulated installation can operate have generally been unsuccessful. A previous attempt by a state to restrict nuclear thermal discharge was struck down in the courts, and the Supreme Court just last week ruled that states may not regulate federal installations unless Congress has provided "clear and unambiguous" authority to do so. Utilities are now considering whether to challenge the new laws in court.

Antinuclear propositions similar to the California one have been placed on the ballots of Oregon and Colorado, with seven more under active consideration. An industry spokesman says, "A lot of wind has been taken out of their sails." But environmentalists claim partial victory because of the new laws. □

Individual atoms dance for camera



The first motion picture of single atoms has been produced by Albert V. Crewe and Michael Isaacson using a field emission electron microscope with magnification $\times 10$ million. The photos above were exposed five minutes apart and show uranium atoms (white dots) magnified $\times 5.5$ million on a thin carbon film (dark background). The movement, caused by atomic interactions and thermal motion, is indicated by arrows where it is most apparent. The filmstrip produced by the two University of Chicago scientists documents two hours of real lapsed time.

Signs of the continents' sudden split

The accumulated sediment on the floors of the world's oceans has been telling a fascinating story to scientists aboard the research ship *Glomar Challenger* ever since the Deep Sea Drilling Project began in 1968. On Leg 47 of the DSDP, which is also Leg 3 of the expanded version of the project known as the International Phase of Ocean Drilling, drill cores from two sites in the eastern Atlantic added chapters from places as far apart as the Sahara, western Europe and Canada.

At the first site, south of the Canary Islands off the northwestern coast of Africa, the cores amazed the scientists with the unexpected magnitude of the underwater avalanching and erosion that have taken place along the submerged edge of the continent. Fully three kilometers of sediment have been carried away from the base of the continental slope, yet the finding was unexpected because no trace of the powerful currents that did the scouring remains today.

The same site yielded cores containing tiny, spherical, wind-abraded grains of sand, believed to have been transported hundreds of kilometers by the winds of ancient storms. The grains appear to be signs of the early formation of the Sahara Desert, dated as coinciding with global cooling from the first extensive ice cover of Antarctica. The DSDP team, headed at this site by William Ryan of Lamont-Doherty Geological Observatory and marine geologist Ulrich von Rad of West Germany, was also able to determine that the Canary Islands emerged only during the most recent 10 percent of the Atlantic Ocean's lifetime. The initial volcanism that led to the formation of the islands

took place under water. The core samples revealed golf-ball-sized fragments of the lava from those eruptions in layers several meters thick even though the drill site was nearly 100 kilometers from the islands.

A further sign of the strength of the erosion along the African continental apron was discovered in a single core sample 9 meters in length, but spanning a period from 20 million to 120 million years ago. The constant pressure of the now-vanished currents had carried away more than half of the expected sedimentary record of the area's history.

It is not unreasonable to assume that changes in the currents in the area were connected with the growing separation, long ago, between Africa and South America. The second Leg 47 drilling site, west of Portugal, suggested that similarly dramatic mechanisms may have been part of the widening of the narrow sea that once was the only divider between present western Europe and North America. According to Ryan and Jean Claude Sibuet of CNEXO in France, chief scientists for the site, "The ultimate collapse of the adjoining line between the continents appears to have been remarkably abrupt from a geological viewpoint, leading to a practically simultaneous drowning of the land's edge as the earth's crust tore asunder and drifted apart." Fossil dating confirmed earlier theories that the separation began about 100 million years ago; it was the apparent suddenness of the event that the core tubes revealed.

The second site also set a new record for the DSDP, penetrating 1,740 meters into the bottom. The water depth over the record-setting hole was 3,900 meters. □