covered from the land, once the magnet is installed the gondola will be so topheavy that the group would prefer to recover it from water. HAPPE 7/8 successfully demonstrated that they could retrieve the gondola from the Pacific with the help of a big ocean-going derrick.

Experiment. HAPPE 2 is expected to collect about 1000 protons per hour and twice that many electrons.

The experiment will measure the momenta of charged secondary particles produced when cosmic-ray protons strike a lithium-hydride or beryllium target, which covers half the spark-chamber area. Since neutral particles will not be detected, one will get only a rough estimate of the primary proton energy.

Wahlig explained that the experiment will offer the first really high-energy check on various statistical models, which predict the number of secondaries, their angular distribution and their momentum distribution.

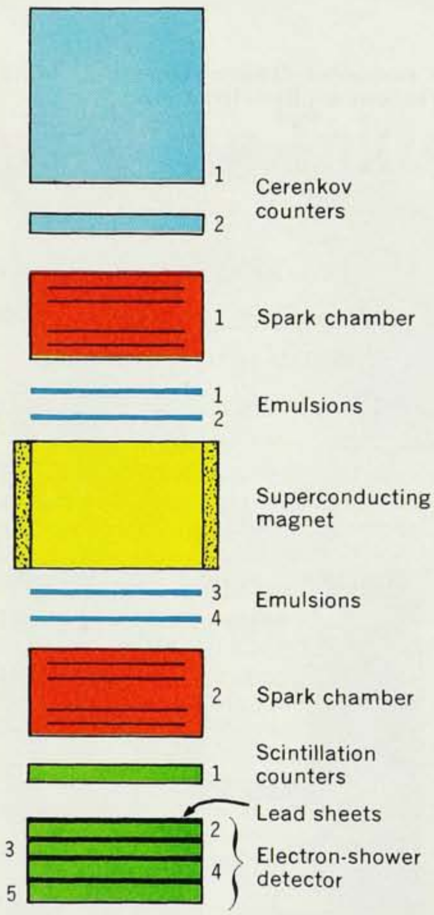
To define its high-energy beam, HAPPE 2 will measure proton and electron spectra. The group will also try to study the flux of particles with high atomic number (light output of the counters is proportional to Z^2), but for heavier particles it will be difficult to correct for the air above the gondola. The high-energy electron spectrum is of great interest because it is expected to be affected by inverse Compton scattering, in which the electrons are scattered by photons in the primordial blackbody radiation.

Future plans. Since the statistical theories are actually for proton-proton interactions, Wahlig noted, one really should have a hydrogen target; so in HAPPE 3 the group plans to put a small hydrogen target above the magnet. Then they can see how many rho mesons or f^0 mesons are produced, and they can study the invariant mass of pairs or triplets of particles, as well as getting statistical properties.

Below the magnet they expect to put a large H_2 target, about two meters long, to study p-p total cross sections. They may also be able to measure p-p elastic scattering, but this will depend on how bad the background is.

The HAPPE flights will search for antimatter in cosmic rays. Alvarez says that if they find just one antihelium particle, the experiment "will have paid for itself." (Such an observation would be strong evidence that some neighboring galaxies are made of antimatter.)

One possibility is to move HAPPE onto a satellite, where statistics of course would improve greatly. The Berkeley group has teamed up with a cosmic-ray group under Wilmot Hess, of the Manned Spacecraft Center, in making a formal proposal for a high-energy cosmic-ray laboratory in one of the Apollo Applications Program (AAP) satellites. —GBL



DETECTION APPARATUS for HAPPE 2, which will detect cosmic-ray protons with momenta from 100 to 3000 GeV/c. Electron-shower detector tells whether electron or proton triggered Cerenkov counter. 9.5-kG superconducting magnet has open center bore 1 meter in diameter. HAPPE 2 will be launched by balloon in the summer of 1969.

More on CP Violation: Experiments Disagree

Last fall many high-energy physicists felt that the phenomenological description of CP violation in K meson decay was at last complete (PHYSICS TODAY, November, page 73). Now the situation is up in the air again. At the Chicago APS meeting, in a special session on K^0 decay, two new experiments suggest that we still do not know the value of $|\eta_{00}|^2$, the ratio of the two-neutral-pion decay rate of $K_2{}^0$ to the two-neutral-pion decay rate of $K_1{}^0$.

When experiments at CERN (by Jean-Marc Gaillard and his collaborators) and at the Penn–Princeton accelerator (by James Cronin and his collaborators) were reported early last year, the preliminary value for $|\eta_{00}|$ appeared to rule out Lincoln Wolfenstein's superweak theory, which predicted a value half as great.

One new experiment, reported at the meeting by T. Kamae of Princeton, finds $|\eta_{00}|$ is 2×10^{-3} with error limits of $+0.7 \times 10^{-3}$ and -2×10^{-3}. The other experiment (jointly conducted by the U. of California, Berkeley and the U. of Hawaii), still in extremely preliminary stages, reported by Sherwood Parker, gives $(3.2 \pm 0.6) \times 10^{-3}$ (however, it is too early to estimate systematic errors). Earlier reported values were no smaller than 3.9×10^{-3}. Rumor has it that data from a new CERN bubble-chamber experiment are substantially smaller than last year's preliminary values.

Sentiments expressed at the Chicago meeting include: "It looks good for Wolfenstein again." "I never liked the Wolfenstein theory. It tells us that the only way the superweak force can be observed is in the CP-violating decay of $K_2{}^0$, and that's too frustrating." "The experiments still haven't ruled out the $\Delta S = -\Delta Q$ explanation for CP violation." "Let's wait and see."

Electric Field Suppresses Lambda Point in Helium

By applying a strong electric field to liquid helium Harris A. Notarys of Ford Scientific Laboratory, Newport Beach, Calif., has completely stopped superfluid flow. The only previous way to suppress the superfluid transition temperature T_λ was by applying pressure. Results are reported in *Phys. Rev. Letters* **20**, 258 (1968).

The helium flowed through a porous mica sample, 5 microns thick, that had diamond-shaped pores with sides 0.08 micron or 0.16 micron long. Notarys measured flow rate as a function of applied electric field.

For all pores and fields up to 2 MV/cm Notarys found strongly temperature-dependent effects within 15 millidegrees of T_λ. For the larger pores at 1.5 mdeg below T_λ, the superfluid flow was stopped completely by fields greater than 1.2 MV/cm.

One explanation for the effect is electrostriction: The density of the liquid is greater in a region of high electric field; so the lambda point will be lowered just by the pressure increase.

Another possibility, Notarys says, is that the electric field is behaving with a superfluid the way a magnetic field does with a superconductor, thus causing the phase transition to become first order and supplying the latent heat needed.

Notarys is planning to use these techniques in a search for the superfluid analog of the dc Josephson effect. He would use two containers of superfluid helium (analogous to two superconductors) separated by a weak link, a set of small pores in which one applies an electric field to turn off the superfluidity (analogous to a thin insulating layer). If the effect shows up, superfluid flow will occur across the link without a driving force. The superfluid analog to the ac Josephson effect was observed by Philip Anderson and Paul L. Richards, in 1965.

GROUNDBREAKING FOR LOS ALAMOS MESON FACTORY (PHYSICS TODAY, December 1966, page 21 and November 1967, page 75) was held indoors in February. Senator Clinton Anderson (D-N.M.), AEC Chairman Glenn Seaborg and Louis Rosen wield shovels. Bureau of the Budget has just released $3.7 million for construction; $4 million for design and engineering have already been allocated and the bureau is holding $6.7 million more in reserve. President's fiscal 1969 budget asks for $26.4 million. Total cost is $55 million.

Double Beta Decay Appears To Confirm Existing Theory

A long and careful search for double beta decay (simultaneous emission of two electrons) appears to confirm that leptons are conserved. C. S. Wu, R. K. Bardin, P. J. Gollon and J. D. Ullman of Columbia have found 69 events that may be the kind expected if leptons are conserved—that is, events in which two electrons are emitted with two neutrinos. Meanwhile, in 1100 hours of observation, they found only one event that might be a double beta decay without neutrinos.

Accepting this event leads to a lower limit of 1.6×10^{21} years (at the 80% confidence level) for neutrinoless double beta decay. This value implies that the fraction of the beta interaction amplitude that does not conserve lepton number is less than about 10^{-3}. The group has reported its results in *Physics Letters* **26B**, 112 (1967) and at the Tokyo Conference on Nuclear Structure last September.

Wu and her associates made their observations 680 meters down in an Ohio salt mine by photographing tracks in a helium-filled streamer chamber. Their apparatus (figure) had a Ca^{48} source in the center and cameras at both sides. Surrounding the chamber were counters designed to take pictures only when they saw coincident events with appropriate total energy.

The double-beta-decay search started nearly 30 years ago when the purpose was to determine whether neutrinos and antineutrinos were identical. After nonconservation of parity showed that neutrino and antineutrino have opposite helicities, emphasis shifted, and double beta decay offered the best test of lepton conservation. With lepton conservation one expects two electrons and two antineutrinos; otherwise phase-space considerations strongly favor two electrons and no neutrinos.

Thus the experiment looks for two possible decay modes: neutrinoless double beta decay, in which the electrons carry off all the available energy, and two-neutrino double beta decay, in which neutrinos and electrons share the energy, and the electrons, on the average, get about half. Observations that would show only two-neutrino decay would be confirmation of existing theory; even a little neutrinoless decay would show that leptons are not conserved.

Most searches have used isotopes predictably unstable to double beta decay surrounded by counters to detect coincident electrons. Background is always a problem; accidental coincidences, contamination with undesired beta emitters, cosmic rays, internal conversions and Compton scattering in which photons produce electrons, and even electrons that go all the way through the apparatus cause spurious counts.

Many ingenious modifications have been applied recently in efforts to beat the background. A large liquid scintillation counter was an anticoincidence shield in a recent Case Institute experiment.[1] The double-decay material was made into a scintillating crystal for a Brookhaven group[2] and into a semiconductor detector by a group at Milan.[3] At the University of Pennsylvania a group observed electron tracks in a spark chamber.[4] In all of these experiments, however, background counting rates were still much higher than the expected rate from two-neutrino double beta decay.

But streamer-chamber photographs