is for basic research; less than three percent of that is now classified.

And it became clear last week, as more than 400 physicists attended a symposium on military research and the university at the annual American Physical Society in Washington, that feelings are also high—and divided.

There were few who went along with Dr. William C. Davidon, associate professor of physics at the Haverford College, who proposed a blanket rejection of all military research awards in an effort to channel Federal funds for science through civilian agencies.

The view of Dr. J. O. Rasmussen of Berkeley, who opposes classified research and the inability it entails for a researcher to publish or even consult with colleagues, struck a more broadly responsive chord among the physicists.

But it was matched by support for the view of Dr. Richard L. Garwin of Columbia University who argued that research was necessary to the national security and that funds for such research can be spent to the benefit of both the university and the Department of Defense.

And what the White House official called "the party line—the one I adhere to," was struck by Dr. Charles H. Townes of Massachusetts Institute of Technology, who argued against any "inappropriate absolutism" that would lock a university administration into a possibly untenable position. Classified research, he argued, would have to be undertaken in time of national emergency, and either a vigilant faculty committee or a strong administration could certainly guard against abuse in other times.

The official view in Washington now is that universities should have the freedom to choose their own course.

Dr. John S. Foster Jr., director of defense research and engineering, recently announced a policy that bars classification from all new basic research awards, while permitting those now in force to run their course.

Some of those projects, it has been decided, were classified without adequate reason, for the convenience of the Pentagon. For instance, classification was imposed in some cases to permit a researcher to consult with defense officials and receive classified material, even though his own research was of a nonsecret nature. Some 128 projects are involved.

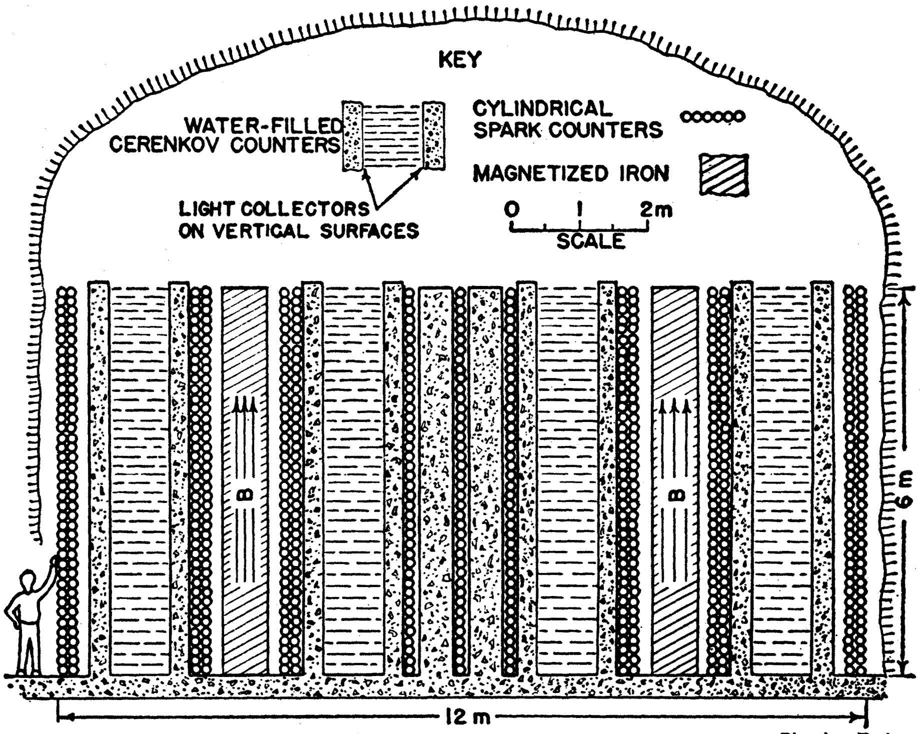
But if the universities should decide to disassociate themselves from applied research, it could hamper the Pentagon. "The IDA case is a problem," says an official, concerned over reports that universities besides Michigan are contemplating a quarantine. Just under 10 percent of the Defense Department's $1.5 billion applied research budget is spent in universities, and another $83 million in university-run contract research centers like Cornell's, Pennsylvania's and Johns Hopkins'. Twenty-two percent of the applied projects are classified and, despite policy shifts, are likely to remain so.

If, as Dr. Rasmussen proposes, all classified research comes off campus and is done in Federal laboratories or contract research centers, both the needs of the Pentagon and the universities might be served. Pennsylvania is apparently able to live with such an arrangement, even if Cornell is not.

Such divisions are regarded as reasonable approaches, and will presumably be encouraged in the future.

"They permit us," says a university official, "to serve the needs of the Defense Department off campus, while not doing anything on campus that we can't discuss with our graduate students."

At Johns Hopkins, for instance, the board of trustees will act next month on a faculty recommendation that would channel all classified research through the Applied Physics Laboratory unless, according to provost Dr. William Bevan, an academic division can make a strong enough case for taking on a job that would restrict its freedom.



Physics Today

In a Utah mine the search for cosmic neutrinos reveals a new type of particle.

WEAK FORCES

Boson hunters wary

One of the triumphs of particle physics in the early 1950's was the discovery of the pion—a particle predicted almost 20 years earlier by the Japanese theorist Hideki Yukawa as the means for transporting strong forces between particles in the nucleus.

A similar search has been going on in recent years for a particle—called an intermediate boson—that would transmit weak forces: the kind involved in the decay of some unstable particles (SN: 1/13 p. 42).

Studies of particles arriving at an underground detector in Utah make some physicists think they have found intermediate bosons. But others are not sure, especially Dr. H. E. Bergeson of the University of Utah, one of the researchers.

Reporting to the American Physical Society meeting in Washington on the progress of the Utah experiments, Dr. Bergeson cautioned against jumping to conclusions without matching theory carefully with experimental results.

The tests have found evidence of the existence of a particle that needs to be explained, however, and the chance that it may be the looked-for boson is appealing.

Of the four kinds of forces that physicists hold accountable for natural phenomena the weak interaction has been most puzzling. The weak force is a little hard to fit into the scheme of things; most of the particles that decay through weak interactions have no known function. Each of the other forces has a role in the structure of

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the universe—the gravitational force holds galaxies and other astronomical systems together, the electromagnetic force holds atoms and molecules together, and the strong or nuclear force holds atomic nuclei together.

In studying forces, physicists have concluded that they are exerted between particles by exchanging a third, intermediate particle. The theory of weak interaction that has so far evolved demands that it, too, have a special particle to serve as carrier.

The intermediate particle for the strong interaction is the Yukawa pion. The intermediate for electromagnetic forces is the photon or light particle, and that for gravity is called the graviton. The intermediate for the weak forces is the intermediate vector boson.

Pions and photons are seen every day in large numbers. But nobody has ever positively identified an intermediate boson. Nobody has ever seen a graviton either, but that is not so serious to particle physicists since gravitational force is so weak that single gravitons are much too insignificant to be detected.

The intermediate boson, however, is something the particle men have wanted badly to find. They have looked literally high and low, and at energies in between, in many experiments at accelerators, without success.

Now, despite Dr. Bergeson's caution, they sense promise.

The experiment at the University of Utah originally intended to look for cosmic neutrinos—elusive particles thought to be present in cosmic rays. The experiment is a large array of detectors that record muons, which are supposed to be produced when neutrinos interact with matter. The detectors are buried deep underground in a mine near the University of Utah, to shield them from unwanted particles that could ruin readings.

When the muons were counted and analyzed, Dr. Bergeson reports, the result was widely different from what had been predicted, taking into account all known means of muon production including those produced from cosmic neutrinos. On this basis some physicists have concluded that intermediate bosons which theory says should decay into muons, were responsible for the difference.

Corroboration is being sought elsewhere.

At the end of March Texas A&M University announced that some of its physicists, in association with physicists from the University of Toulouse, were about to install counters in a tunnel under Mont Blanc to test the idea that intermediate bosons are responsible for the muons (SN: 3/9 p. 240).

Dr. Bergeson took the conservative position in his APS report. The evidence shows definitely that "a new parent" for the muons has to exist, he says, but one should not jump to the conclusion that it is the intermediate boson. Those who would like to believe so should check the theoretically predicted rate at which intermediate bosons would produce muons very carefully against the experimental evidence.

MORE HASTE . . .

A space leap forward

The first and only unmanned test flight last Jan. 22 of the Apollo lunar module was hardly an unqualified success (SN: 2/3 p. 114). Among other difficulties, the vehicle's descent engine, which is the one that will finally lower two U.S. astronauts to the moon's surface, shut off after only four of a planned 39 seconds. Apollo officials, however, decided that the difficulties could be overcome in ground tests, and recommended to space agency head James E. Webb that he cancel the proposed second unmanned flight test. Which he did last month.

A similar recommendation was made to Webb last week on the only remaining unmanned flight. If the officials' recommendations still carry as much weight as they did a month ago, the next Apollo flight will carry astronauts, the first U.S. spacemen to fly since James Lovell and Edwin Aldrin orbited the earth aboard Gemini 12 in November 1966. Webb must balance speed against safety in his decision; presumably the recommendation will be accepted.

Webb has strong reason to go along with his advisers. Besides saving an estimated $200 million, the elimination of a third unmanned Saturn 5 mission could save two or three months in getting Apollo astronauts into space.

There have been two unmanned test flights of Apollo's giant Saturn 5 booster; the first was a jewel, but the second, last April 4, was marred by three major engine failures. Originally, the space agency had said that two successes would be necessary to qualify the Saturn 5 for carrying men, but now, as with the Lunar Module flight, the officials believe that they can straighten out the booster troubles as well on the ground and go ahead with a manned flight.

DRUGS

Why addicts relapse

Evidence is coming to light which may challenge most of the assumptions on which the treatment of drug addicts is based. It is beginning to appear that, at least physiologically, once an addict always an addict.

Cures for the addict's condition often are not designed with the patient very much in mind. The most famous is the cold-turkey cure, in which the unfortunate victim is suddenly and totally deprived of his drug then locked in a room to suffer the pangs of withdrawal.

The theory is that once the addict or alcoholic has gotten past withdrawal, he will be free of his curse and can once again be an upright citizen. Fear of withdrawal symptoms is considered to be the only thing which sends the junkie back to the pusher.

This theory has never really worked. So-called detoxified patients have an alarming relapse rate. Attempts to pin the return to drugs on character or psychological factors have failed.

Science is beginning to make at least educated guesses as to why the theory doesn't work.

The question of why addicts relapse was the central theme of a symposium of the 105th annual meeting of the National Academy of Sciences last week.

Drs. Joseph Cochin and Conan Kornetsky of the Boston University School of Medicine discussed work in which they have demonstrated that a single dose of morphine produces changes in a rat detectable nine months later. They say an animal brought to full tolerance of the drug (i.e. addiction) shows detectable physical changes as much as 15 months after the last dose.

The changes consist of elevated tolerance for the drug; it takes more morphine to affect the once-dosed rat than it does in the never-dosed rat.

While the mechanism by which the drug exerts its effect is still hotly debated, Drs. Kornetsky and Cochin claim that any long-term effect must argue against the weak-will theory of relapse.

Permanent change easily could mean permanent addiction, Dr. Vincent P. Dole of Rockefeller University believes. He is involved in an experimental program in New York under which some 700 opiate addicts are being treated with a drug called methadone.

Methadone is a substitute narcotic. So long as the dose is controlled, it produces no euphoric effects while blocking the addict's craving for heroin. But enough methadone produces both addiction and euphoria, according to the U.S. Public Health Service Addiction Research Center in Lexington, Ky. The center has treated methadone addicts. Its interest now focuses on a non-narcotic block called cyclazocine.

Dr. Dole, nevertheless, says methadone has the single discernible effect, when properly administered, of blocking the addict's craving for dope.