bate over which of five contending sites to choose (The Federal Republic of Germany said that it would reconsider its support if its site at Drensteinfurt, Westphalia was not chosen) could be settled by not choosing any of those originally proposed. John B. Adams, director of the proposed accelerator, told PHYSICS TODAY that the Meyrin site would be cheaper than the others. The lower cost would be partially because development effort, overhead costs and services could be shared with the existing laboratory, but mainly because the existing proton synchrotron would be used as the injector of the 300-GeV machine and an existing experimental hall would be used as its first research area. With the lower cost there is hope that some of the nations that refused to support the 300-GeV project (such as the UK) might decide to put up the smaller amount required.

John Blewett, head of advanced accelerator design at Brookhaven, believes that pulsed superconducting magnets suitable for a synchrotron ring will be developed within a couple of years; so the new CERN proposal could eventually yield an accelerator of higher energy than Batavia. The magnets could probably be pulsed once every three seconds, Blewett said.

Brookhaven, Lawrence Radiation Laboratory, the Rutherford High-Energy Laboratory, Saclay and Karlsruhe have large programs in producing pulsed superconducting magnets. The problem with them is that although they are lossless during static conditions, they dissipate energy when the field is changing. Because this power must be removed at cryogenic temperatures, expensive refrigerators are required. If power loss can be kept small, the technique is feasible. —GBL

Principle for a Pi–Pi Collision Device Proposed

"Precetron" is the name for a new kind of storage and collision device proposed recently by Bogdan Maglic of Rutgers University and Robert Macek of the Los Alamos Meson Physics Facility (reported in the new Gordon and Breach journal *Particle Accelerators*, April 1970). Unlike the usual storage rings, which provide particle interactions through colliding beams of relatively high intensity, the precetron is a device in which particles interact over their entire orbit; the orbits themselves are precessing—hence the name. Maglic and Macek told us that the new device would produce observable collision rates—up to 1000 per hour—with unstable particles (whose lifetimes are as short as 10^{-8} sec), in addition to low-intensity uncollimated stable-particle systems.

To produce pion–pion collisions an extremely short burst of protons (say 800 MeV) strikes a metal target, which is placed in the center of a 400-kG (pulsed) magnetic field. Pion orbits are almost circles (a few cm radius) tangential to the target. Positive pions precess in one direction, negative in the other. Because of their precession, particles in all orbits, regardless of production angle, will eventually collide. Maglic believes that the precetron would have particle momentum acceptances 10 to 50 times higher than colliding-beam devices and solid-angle acceptances 100 to 10 000 times higher. Because the collision rates are proportional to the square of the intensity, a precetron would have up to 10^{8} times the collision rate of a conventional storage ring.

After a while the pions decay into muons, which also precess, and μ–μ collisions occur, too.

Maglic is designing a model to be built at Rutgers employing low-energy electrons and positrons instead of pions. Eventually Macek and Maglic propose to use the precetron at Los Alamos for π–π collisions in the energy region of the rho meson.

A search for electromagnetically produced π–π states (spin 1) over a fairly wide mass range is already under way at the Adone electron–positron storage ring (1.5 GeV/beam) in Frascati, Italy. So precetron will have to prove itself better than an existing Goliath, although the precetron idea appears applicable to collisions of other unstable particles, too; furthermore, the π–π scattering in precetron is not restricted to spin-1 states.

How soon a precetron would be used to do physics experiments is still not clear. Detector considerations may bar its use altogether, Maglic says, but in their journal article the authors suggest possible solutions by outlining a new way of doing experiments. One serious difficulty is separating the variety of π–π and μ–μ processes, and determining energy and momenta of particles produced. Furthermore, backgrounds from pion and proton collisions with nuclei in the production target might swamp the signals coming from π–π and μ–μ processes. —GBL

Lithium-drifted Germanium Measures Gamma Polarization

A simple high-resolution method for measuring the linear polarization of nuclear gamma rays has been developed by groups in Czechoslovakia (J. Honzatko and J. Kajfosz), in Canada (Albert E. Litherland, University of Toronto, George T. Ewan, G.I. Andersson and Gilbert A. Bartholomew at Chalk River Laboratories) and at Johns Hopkins (Yung-Keun Lee, George E. Owen, J.W. Wiggins and R. Wagner). One places a single slab of lithium-drifted germanium so that the gammas strike the edge of the detector. The technique shows promise as a new tool for nuclear spectroscopy.

Compton scattering of linearly polarized gammas occurs preferentially in a plane perpendicular to the electric vector. In a lithium-drifted germanium detector most events contributing to the full-energy peak, for gammas whose energy is greater than 300keV, arise from Compton scattering followed by total absorption of the scattered photon. So if the incoming gammas hit the edge of the polarimeter the counting rate in the total absorption peak will be a maximum when the plane of the detector is perpendicular to the electric vector and a minimum when it is parallel to the electric vector. One can deduce the polarization from the change in counting rate in the total-absorption peak when the plane of the counter is rotated through 90 deg.

The Canadian group has built two such detectors; the larger one is $60 \times 35 \times 6.5$ mm. These polarization-sensitive gamma detectors have the high resolution properties of standard lithium-drifted germanium detectors and are relatively simple to use.

Spin-Flip Raman Laser Is Tunable Infrared Source

An intense laser source has been built which, by varying the applied magnetic field, is smoothly and continuously tunable in the infrared range of 10.9–13.0 microns. Other kinds of tunable sources—parametric oscillators—are available in the visible and near-infrared (but not infrared). At the APS Washington meeting late in April, Kumar Patel (Bell Labs) described the experiment. He and Earl Shaw[1] shone a 10-micron CO_2 laser onto an n-type indium antimonide crystal and applied a strong magnetic field (varied from 20 to 100 kG) perpendicular to the laser beam.

Another way of generating tunable infrared radiation is to use Raman scattering from polaritons. Because a polariton, by definition, has both optical and mechanical character, the lattice vibration excited during the stimulated-scattering process radiates in the infrared. One can tune by varying the angles of incidence and emission. Experiments last year by groups at Bell Labs,[2] Stanford[3] and the Institute of Optics at Orsay[4] have demonstrated that the technique works.

Raman scattering occurs in the new experiments when the conduction electrons in the crystal flip their spins in the magnetic field. The frequency of the shifted light varies as $\omega_S = \omega_0 - g\mu_B B$; ω_0 is the pump frequency, μ_B is the Bohr magneton, B is magnetic field and g is the effective gyromagnetic ratio of the electrons in indium antimonide.

Three years ago Patel, Richard Slusher and Paul Fleury produced spontaneous Raman scattering from the spin-flip process in indium antimonide, indium arsenide and lead telluride; the shifted-frequency light is, however, weak. Since then Patel has intermittently been trying to also produce stimulated Raman scattering, in which one builds up several photons per mode in the scattered radiation; these then begin to react back on the primary, and the process avalanches. Patel and Shaw have now achieved the stimulated scattering. About 10% of the primary power is emitted by the crystal at the shifted frequency.

The CO_2 laser can emit thousands of watts, but the Bell experimenters have made the stimulated Raman scattering occur with input power as low as 300 watts; Patel believes he may be able to reduce power much further. At 1-watt output the linewidth was less than 0.03 cm^{-1}. Laser pulses last about a tenth of a microsecond. Other pump lasers will probably also work, for example the carbon monoxide laser, which emits at 5 microns; if so, one could tune from roughly 5.5 to 7.5 microns.

In the experiment the indium antimonide provides electrons with a very high effective magnetic moment, 25 times higher than free electrons. The energy change, and therefore the frequency range over which one can sweep, is proportionately multiplied. Indium antimonide is well behaved in other ways; it is sturdy and has very high optical transmission in the correct frequency range; so the efficiency of the Raman laser is high. Bell experimenters are now speculating about other suitable materials.

One puzzle raised by the experiment is why, when one tunes the magnetic field, the frequency of the spin-flip laser tracks exactly (within experimental limits). Because the crystal is an optical cavity for the radiation, one might expect that as the field is raised and one passes through the natural frequencies of the cavity, there would be some sort of nonlinear coupling that would pull the frequency. Although frequency was not affected by the cavity, power output was; it increased by about 10% at the natural frequencies.

An obvious application of the tunable spin-flip Raman laser is for infrared spectroscopy. Patel, Shaw and Rudy Kerl have already used the laser to obtain infrared absorption spectra for ammonia that have better resolution than any previously obtained with grating spectrometers. —GBL

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Berkeley Group Calls Element 105 Hahnium

The discovery of element 105 was reported by Albert Ghiorso (University of California, Berkeley) at the Washington APS meeting; he suggested calling it "hahnium" in honor of Otto Hahn, codiscoverer of nuclear fission.

Two years ago Georgi N. Flerov (Joint Institute for Nuclear Research at Dubna) had reported the discovery of element 105 (PHYSICS TODAY, December 1967, page 61). Ghiorso believes his experiment shows that Flerov's initial experiment was wrong, but not that a second recently reported Dubna experiment, in which Flerov found a spontaneous fission halflife of 2 sec, was necessarily wrong. The Dubna group has not proposed a name, however.

In the Berkeley experiment Ghiorso, Matti Nurmia, Kari and Pirkko Eskola and James Harris bombarded a 60-microgram target of Cf^{249} with 84-MeV N^{15} ions from the HILAC, producing ${}_{105}X^{260}$, which decayed with a halflife of 1.6 sec, according to Ghiorso; the alpha-decay energy was about 9.1 MeV.

Ghiorso is eagerly awaiting the modification of HILAC, which is to be shut down in February; six months later it is scheduled to become super-HILAC, which should be capable of accelerating ions as heavy as uranium. It is expected to make 10^{12} ions/sec at 2 GeV.

To Interstellar Pollution List Add Carbon Monoxide

Carbon monoxide has been detected in the Milky Way. The eighth molecule to be found in space was reported in April (in an International Astronomical Union Circular) by Keith Jefferts, Arno Penzias and Robert Wilson of Bell Labs. Using the 36-foot telescope at Kitt Peak, the observers found a CO line in emission at 2.6 mm in at least five sources in our galaxy.

OH, CH, CH^+ and CN molecules have been known for some time in interstellar space. Now that formaldehyde, ammonia and water have also shown up lately, one wonders where all this interstellar pollution is coming from. Where will it all end?

IN BRIEF

Mount Wilson and Palomar Observatories have a new name—the Hale Observatories, in honor of George Ellery Hale, famed American astronomer and founder of both observatories. The Hale Observatories, with a staff of over 120, are operated jointly by the Carnegie Institution of Washington and Cal Tech. Horace W. Babcock is director of the observatories. J. Beverly Oke has recently been appointed associate director.

The CERN–IHEP Boson Spectrometer, part of the second CERN–IHEP collaboration, was shipped to IHEP (Institute for High-Energy Physics), in Serpukhov at the end of March. In the experiment negative pions strike a hydrogen target, scintillation counters select desired events and then trigger a wide-gap spark chamber. W. Kienzle of CERN and G. Landsberg of IHEP lead the collaboration. □