out that similar phenomena have been observed over the last ten years in various unstable plasma discharges, and that in those experiments the neutron production is of beam-target origin rather than thermonuclear in nature. However as a result of the large spread in ion angles in these experiments, neutron isotropy is not a valid indication of a hot thermalized plasma, he says.

J. W. Poukey at Sandia has developed a numerical technique to model the self-pinch in the diode plasma. He reported at Monterey that the combined effects of the longitudinal electric field along with the self-magnetic field of the beam within the charge neutralizing plasma are responsible for the "super-pinch." These computational results have been compared with experiments conducted on two Sandia accelerators in which current densities of 5 MA/cm^2 were obtained. This was accomplished using a 17-cm diameter cathode and an accelerating gap of 0.6 cm to produce a diode impedance of 3 ohms (as compared with impedances an order of magnitude higher obtained with dielectric rods), Yonas says. Experiments are now underway on Sandia's Hydra accelerator (1 MeV, 1 MA, 80 nanosec) to extend these concepts to machines with sufficient energy in the electron beam to begin to explore pulsed fusion concepts in detail. Yonas states that their approach will be to employ as few as two cathodes in a single machine to carry out spherical-pellet implosion experiments. Such a machine is now under development by T. H. Martin and his coworkers at Sandia.

At the Naval Research Laboratory Gerald Cooperstein and his collaborators are using the NRL Gamble I generator, which has an output into a matched 1.5-ohm load of 500 kA at 750 kV with an 80-nanosec pulse length and 20-nanosec voltage rise time. An intensely self-focused beam is generated from a 1-cm-diameter hollow cathode. Cooperstein says they prefer a large diameter because it matches better with the low-impedance generator. Pinching occurs in the diodes, he says, because the radial electric fields generated by the space charge are shorted out in the anode plane, allowing the self-magnetic field to dominate. The self-focused beam, which has been compressed from 10 cm to 1 cm in diameter, is further compressed to less than 3 mm in diameter at it passes through the anode plasma and becomes charge neutralized. The NRL group measures current densities greater than 1 MA/cm^2.

Another group at the Naval Research Lab, Ihor Vitkovitsky and his collaborators, are using the Gamble II device, which has an open-circuit voltage of 2.0–2.5 MV and a short-circuit current of 1.5 MA; 200 kJ are stored in the machine. Rather than create an electron beam in a vacuum diode, this group explodes very fine tungsten wires, 3.5–4.0 cm long, which are placed at the output electrodes. A very high-energy-density discharge is created, using the wire as the source of material for creating the plasma. The group looks at the plasma as a channel for current flow of electrons into an anode. Because the plasma channel is the only low-impedance path for the electrons to go through in the diode, most of the current is constrained to move in a 1-mm^2 plasma channel.

Vitkovitsky and his coworkers infer that they have peak current densities at the target of about 50 MA/cm^2. They actually only observe 20 MA/cm^2 of electrons over 25 keV; the rest of the current density is inferred. They believe 40 kJ/cm^2 is deposited. Using a deuterated polyethylene anode they observed 10^6–10^7 neutrons/pulse emitted isotropically, which they say are not due to ion acceleration.

In the Soviet Union several laboratories are working with intense relativistic electron beams. At the Lebedev Institute in Moscow A. A. Kolomensky's group is studying collective ion acceleration. So is M. S. Rabinovich's group, and his group is also working on fusion applications. At the Kurchatov Institute in Moscow E. K. Zaviosky's group is also interested in fusion experiments. There are also groups in Novosibirsk and in a new laboratory at Tomsk. Typical parameters for the Soviet machines are under 3 MV and less than 100 kA but there is some discussion about building machines in the several hundred kiloamp, several megavolt range. —GBL

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Kitt Peak solar telescope to support Skylab project

Around the middle of July, solar astronomers at Kitt Peak National Observatory expect to be making the first observations with their new vacuum telescope. With its 60-cm aperture and 33-cm diameter solar image, the new instrument will be complementary to the much larger McMath telescope (150-cm aperture, 80-cm solar image) also at Kitt Peak; it will provide daily monitoring of the sun's magnetic activity on a routine basis not possible with the McMath telescope, which is normally used for individual research projects by KPNO staff members and visiting astronomers.

In a vacuum solar telescope the light-path region is evacuated to avoid image distortion from the convection currents that would otherwise be generated in the intense light beam. Two moving mirrors of the new telescope will track the sun at the top of a 75-ft tower and project the sun's rays down to the 40-ft-deep basement where the spectrograph and magnetograph are located. To simplify the design, the tracking mirrors (called a "coelostat") are at atmospheric pressure and only the optical path in the tower will be evacuated. In some other vacuum telescopes the whole light path is in an evacuated region, but this leads to complex sealing problems at the top of the tower.

Other vacuum telescopes are at Sacramento Peak Observatory in New Mexico (one of the Air Force Cambridge Research Laboratories) and at the Aerospace Corporation's San Fernando Valley Observatory in California. The new one at Kitt Peak has been built as part of a program to supplement the solar observations of NASA's Skylab project with ground-based observations. Skylab, a manned orbiting solar observatory due to be launched next month, will carry six instruments for solar observations at visible, ultraviolet and x-ray wavelengths. Kitt Peak's new telescope will provide routine daily monitoring of the magnetic fields on the sun's photosphere, with a resolution of one second of arc, to complement the Skylab data.

Because of this Skylab support role, part of the new instrument's funding comes from NASA. Of the total cost of half a million dollars, $100 000 comes from NASA and the remainder from NSF. The telescope will be operated by the Association of Universities for Research In Astronomy, under contract with NSF.

Half a million dollars is remarkably cheap for an instrument of this type, William Livingston, astronomer at Kitt Peak, told PHYSICS TODAY. Livingston and Keith Pierce, associate director of KPNO, have jointly been responsible for the design and construction of the new instrument. Some of the equipment has been borrowed, Livingston pointed out, in an effort to keep down costs; for example, the large vacuum-seal window at the top of the tower is a spare on loan from the Sacramento Peak Observatory. —JTS