consists of four internal rings carrying parallel currents in the toroidal direction. Just like all multipoles, the device has axial symmetry about the major axis of the torus. Ohkawa designed the device to reduce losses to the ring supports, one of the major limitations in earlier octopoles; it has a plasma volume of 10 000 liters.

In the first experiments Ohkawa used a plasma density of 3×10^{10} particles/cm^3; electron temperature was about 5 eV. In the new experiments Ohkawa pushed the density higher (10^{11} particles/cm^3) and the temperature lower (a few eV), to a regime where one should get classical diffusion. Ohkawa did indeed observe classical diffusion for the first 150 millisec; then the behavior smoothly changed and became Bohm-like. His measured decay time of 200 millisec corresponds to about 300 times the Bohm value.

Although the octopole confinement is the longest observed in any toroidal device, its plasma is cold and dilute and not likely to be scaled up into a reactor because of the interior rings. (General Atomic plans to build a Doublet device, in which internal conductors are replaced by plasma current.) However, because the octopole plasma is well contained one might now try to understand what effects are responsible for the enhanced confinement and then apply the knowledge to a geometry that is more suitable for a fusion reactor.

The Tokomak plasma is already nearly thermonuclear; it gives neutrons, it is hot and it is dense. At Dubna N.J. Peacock and D. C. Robinson of Culham Laboratory and N. Sammikov of the Kurchatov Institute reported that Tokomak T-3 produced in one mode of operation electron temperatures of 900 ± 100 eV and confinement times of about 25 millisec with a density of 2×10^{13} particles/cm^3. Earlier measurements by Kurchatov had yielded 3×10^{13} particles/cm^3 at 1000 eV and 20 millisec. The Culham–Kurchatov collaboration determined temperature and density by analysis of Thomson scattering from a pulsed ruby-laser beam.

Air Force Solar Telescope and OSO-6 Now Observing the Sun

Two new devices are now observing the sun—a solar vacuum-tower telescope built by Air Force Cambridge Research Laboratories and OSO (Orbiting Solar Observatory)-6.

The solar telescope is 111 meters high and has a central core that contains the entire optical system, which is evacuated to 0.250 torr. Light enters through a 76-cm aperture, passes through a quartz window and is then reflected by two flat mirrors to the 64-inch (1.62-meter) focusing mirror (focal length 55 meters) at the bottom of the shaft. Theoretical resolving power is 0.2 sec of arc; so one can expect to resolve fine details on the solar disc.

AIR FORCE SOLAR TELESCOPE is 111 meters high. The optical system is evacuated to 0.250 torr.

Because the objective port is high above most air turbulence and heat currents that swirl up when the sun heats the ground, and because the optical system is evacuated, image stability is expected to be excellent. Richard B. Dunn designed the system.

Located in the Sacramento Mountains of New Mexico, the $3.3-million instrument will be used to study solar centers of activity—sunspots, magnetic fields, flares and plage areas. One goal is identification of precursors to solar flares.

OSO-6 is returning data from seven experiments. From its vantage point above the atmosphere, it can study in detail the ultraviolet and x-ray spectra at any point in the solar disc. Its expected lifetime is six months.

IN BRIEF

US and Soviet radio astronomers were to collaborate this fall on the longest baseline ever used for two-telescope interferometry. Telescopes at Green Bank, W. Va., and the Crimean Astrophysical Observatory near the Black Sea—9600 kilometers apart—should provide a resolution of 0.0003 to 0.0005 seconds of arc at a 3-cm wavelength.

Construction has begun on an observatory to house a 40-inch (101-cm) astrometric telescope at the Fan Mountain Observatory of the University of Virginia.

A two-year oceanographic study of the central Mediterranean is taking place. Geophysicists from the Woods Hole Oceanographic Institution, the University of Bologna and the University of Trieste are coöperating in the project and expect to obtain continuous reflection and refraction data from the earth's crust down to the Mohorivicic discontinuity.

Dicke Panel Says US Lags in Radio-Astronomy Construction

The National Science Foundation Ad-Hoc Advisory Panel for Large Radio-Astronomy Facilities, headed by Robert H. Dicke, has decried the lack of US radio-astronomy construction. The panel, originally convened in August 1967 (PHYSICS TODAY, September 1967, page 71), met again to review its original recommendations. In a recently issued report the panel points out that none of the suggestions made two years ago has yet been implemented. The US, it says, has stood still while Germany, India, the Netherlands and the UK have begun construction on large radio telescopes, several of which will soon be in operation.

Noting that discoveries since the panel first met (pulsars, existence of interstellar formaldehyde, ammonia and water) have made construction of new telescopes even more imperative now than two years ago, the panel recommends that:

- the 305-meter spherical-dish telescope at Arecibo, Puerto Rico (PHYSICS TODAY, April, page 65) be resurfaced so that it can be useful for centimeter-wave radio astronomy. Resurfacing was urged two years ago as a relatively inexpensive improvement.
- the Cal Tech proposal for con-

struction of an eight-dish array at the Owens Valley Observatory be accepted.

• construction of a fully steerable 134-meter radome-enclosed dish be begun immediately, probably in the dry southwestern portion of the US.

• construction of the Very Large Array of 27 antennas, as proposed by the National Radio Astronomy Observatory, be begun immediately. This array would produce up to three pictures daily with a resolution of 1 sec of arc, which is equal to that of optical photographs.

• studies of methods for construction of very large steerable dishes be continued. Emphasis should be on design of an antenna useful at wavelengths as small as 3–6 mm.

• support of university radio astronomy be continued and improved.

• grants and contracts for US support of radio-astronomy installations require not only that half the observing time be available to visitors, but also that the installations be managed to assure representation of national interests and maximal usefulness to visitors.

Measuring It Better: A Visit to Bureau International des Poids et Mesures

In an old house in Paris
All covered with vines
Lived twelve little girls
In two straight lines.

If you drive west from Paris toward Versailles, you can easily pass through the little town of Sèvres without knowing that in it is the International Bureau of Weights and Measures. Only when you turn through a narrow arched gateway and climb a few hundred yards through the woods to a small clearing in the Parc de St Cloud do you come to the little historic manor, Pavillon de Breteuil.

The approach and the exterior suggest an atmosphere like that of the lines that open Ludwig Bemelmans's "Madeleine in Paris." Once, in fact, it had such an atmosphere. "Forty years ago," Jean Terrien, the present director told me on a recent visit, "Bureau International des Poids et Mesures had the feeling of an old lady. There were few pieces of original research."

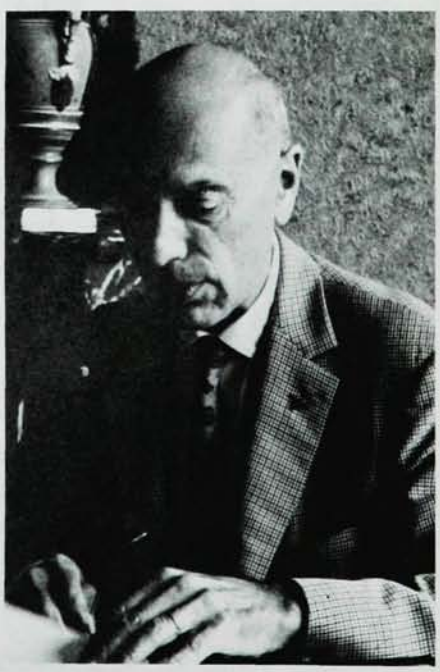
Step inside, though, and you find a different atmosphere. The neat laboratories are making some of the most careful measurements in the world. The aim is to determine standard values and best procedures to measure them. Major concerns are length, mass, time, acceleration of gravity, electrical units, temperature, photometry and ionizing radiation.

The main function of the bureau is coördination of efforts everywhere to define and measure quantities accurately. Its small staff ("about 50 persons including the gardener," said Terrien) can not do such amounts of work as go on at the US National Bureau of Standards and the UK National Physical Laboratory. But it does much to test and compare the methods suggested by these and similar national laboratories. Moreover seven international consultative commitees based at BIPM make the most fundamental decisions required for coördination and coöperation. Their seven subjects are electrical quantities, photometry, thermometry, ionizing radiation, definition of the meter, definition of the second, definition of units.

40 governments have signed the "Convention du Mètre," the 1875 treaty under which BIPM was born. They meet at least every six years and usually every four years in the Conference Générale des Poids et Mesures. (Terrien shuddered at the thought that BIPM might have become part of the League of Nations or the United Nations. As an organization fulfilling a purpose, it is running more effectively than those trying to find purposes they can fulfill.) The 40 elect an 18-member committee, which operates BIPM and the seven consultative committees.

The bureau is in no sense French although it happens to have a French home and a French director. Former directors have been Swiss, Italian, Norwegian and British. It does not even function as a standards bureau

HISTORIC MANOR HOUSE in western outskirts of Paris is home for international bureau that specializes in standard values and best procedures to measure them.



DIRECTOR JEAN TERRIEN was formerly an opticist on staff of the bureau.