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Light Output % Anthracene	Pulse Width ns	Decay Time ns	Light Attenuation Length cm	Maximum Emission Å
60	3.9	3.3	250	4350

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SEARCH AND DISCOVERY

cists, 40 postgraduate students, about 50 engineers doing research and about 100 engineers for the accelerator factory.

Budker says the council members often disagree at their round table. But he is a forceful man, and he usually convinces them to try brave, new ideas.

—GBL

Ultrasonic Microscope May Be More Sensitive, Nondestructive

An ultrasonic microscope might be 10 000 times as sensitive to detail as an optical microscope and offer better signal-to-noise ratio. It would not destroy its samples as do the beams of electron microscopes and the staining required with optical microscopes. Thus you could watch effects as you cause them. To test the principle Marvin Chodorow and Bertram A. Auld plan to build one at the Stanford Microwave Laboratory.

They will use 1000-MHz or higher frequencies to produce 3-micron or shorter wavelengths. After scattering from the specimen, sound waves will be converted to visual images by one of two methods that the builders are now exploring. One is modulation of a light beam, which would make an image on film. The other is scanning the object and putting the image on a cathode-ray tube with television techniques.

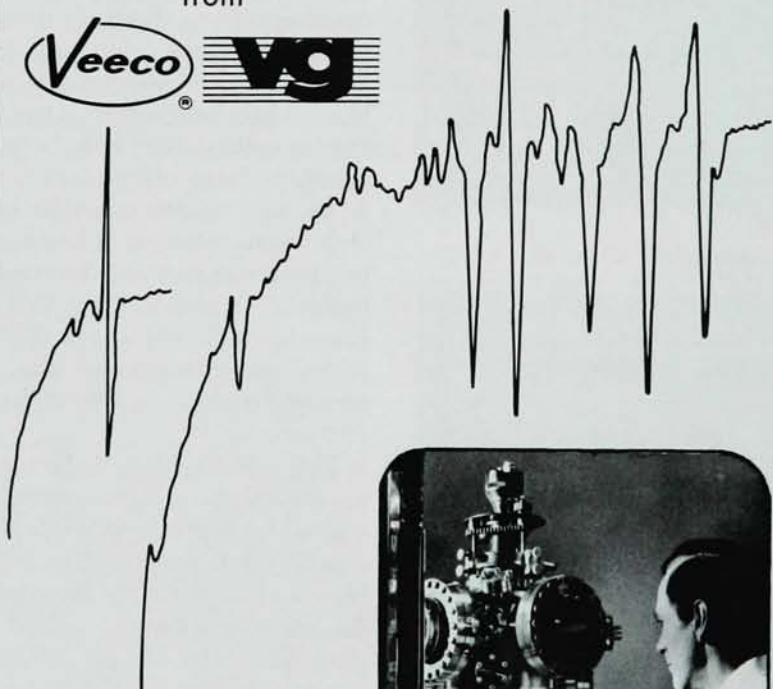
Although wavelength and resolution will be about the same as in an optical microscope, lower frequencies will offer advantages in detection.

Josephson Effect Permits New Look at Fundamental Constants

Our old friends, the fundamental constants, get a new scrub and polish in the July *Reviews of Modern Physics*.¹ Barry N. Taylor (RCA, Princeton), William H. Parker (University of California, Irvine) and Donald N. Langenberg (University of Pennsylvania) offer best values that have estimated errors about a third as large as those in a 1963 adjustment by E. Richard Cohen and Jesse W. M. DuMond.² The values themselves have changed by several standard deviations.

Motivation for the new study came largely from the ac Josephson effect in which an ac supercurrent flows between two weakly coupled superconductors when there is a potential dif-

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New Best Values of the Fundamental Constants

Quantity	1969 value	1969 error (ppm)	Change from 1963 (ppm)	1963 error (ppm)
$1/\alpha$	137.03602	1.5	-20	4.4
e	$1.6021917 \times 10^{-19}$ coulomb	4.4	+57	12
h	6.26196×10^{-34} joule-second	7.6	+91	24
m	9.109558×10^{-31} kilogram	6.0	+52	14
N	6.022169×10^{26} per kilomole	6.6	-58	15

ference between them.³ It permits determination without using quantum electrodynamics of the fine-structure constant $\alpha = 2\pi e^2/hc$, electron charge e , electron mass m , Planck's constant h and Avogadro's number N (see table). Then a comparison with values from QED offers a clue to inconsistency of theory or inaccuracy of measurement.

Taylor, Parker and Langenberg begin their paper with a discussion of the constants, the choices one must make in determining them and the accuracy of various experiments they take into account in their evaluation. Then they search for discrepancies and with least-squares adjustments determine a non-QED value of α . With this value they calculate Lamb shifts, fine and hyperfine splittings and magnetic-moment anomalies. A com-

parison of these values with experiment gives them a test of QED.

With further least-squares adjustments they obtain a final recommended set of constants, and then they conclude their paper with suggestions of further work that might produce more accurate future values. For the next improvement in the fundamental constants, they say, look with particular attention at macroscopic quantum phase-coherence effects in superfluids.

References

1. B. N. Taylor, W. H. Parker, D. N. Langenberg, *Rev. Mod. Phys.* **41**, 375 (1969); to be published also by Academic Press as a monograph.
2. E. R. Cohen, J. W. M. DuMond, *Rev. Mod. Phys.* **37**, 537 (1965); J. W. M. DuMond, *PHYSICS TODAY* **18**, no. 10, 26 (1965).
3. *PHYSICS TODAY* **20**, no. 4, 66 (1967).

Hermes II Produces 150 000 Amperes of 13-MeV Electrons

Sandia Laboratories is operating a high-intensity electron accelerator, Hermes II, that produces a 150 000-ampere beam of 13 MeV in 100 nanosec. The device has a maximal 1-megajoule energy store and has produced 6000 rad at 1 meter.

The bremsstrahlung output of the device is used to simulate the gamma flash (initial gamma-ray output) from nuclear weapons, and one can simulate the weapons effect on electronic

components, according to Thomas H. Martin, who heads electron-beam physics research at Sandia.

Like other recently developed high-intensity electron accelerators (*PHYSICS TODAY*, June, page 59), Hermes II consists of a Marx generator (that has 186 1.0-microfarad, 100-kV capacitors) and a Blumlein transmission line. The electron beam strikes a tantalum target to produce x rays. The device cost about \$900 000.

IN BRIEF

A sector-focused isochronous cyclotron, which produces high-intensity beams of 10-140-MeV protons, was recently dedicated at the University of Maryland.

CW lasers have been pushed further into the ultraviolet. W. T. Silfvast (Bell Labs) built a cadmium laser that operates at 325 nanometers. It can be built and operated with relatively simple techniques, similar to those used in helium-neon lasers, according to Silfvast.

University of Chicago and Illinois Institute of Technology have started a Laboratory of Atmospheric Probing. It will study phenomena ranging from dynamics of severe storms to mechanisms of clear-air turbulence.

A research institute for engineering sciences has been established at Wayne State University in Detroit. The multidisciplinary facility will concentrate on molecular engineering, statistical mechanics and wave propagation. □

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