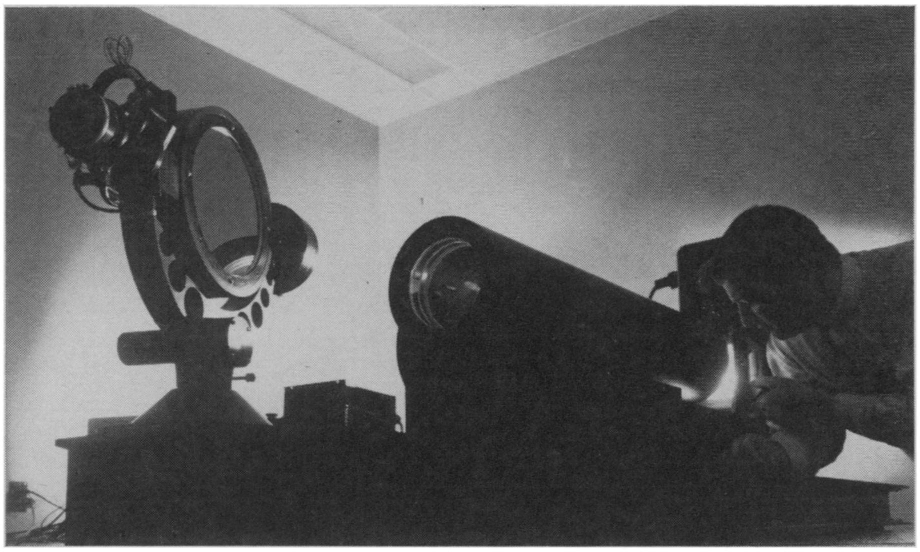

GUIDANCE SIMULATOR—An engineer slips a slide holder behind the precision zoom lens of Boeing's electro-optical guidance simulator. The gimballed mirror (forward) reflects the slide image to a large screen scanned by a missile homing device. High-resolution film makes possible picture detail magnification up to 50 times original size without fuzziness or distortion.

PHYSICS

Test Theory of Relativity

The validity of Einstein's theory can now be checked using automatic clocks because of the increased accuracy by which time can be measured

➤ EINSTEIN'S general relativity theory could be tested now by comparing how atomic clocks at sea level keep time with those placed atop Mt. Everest.

The comparison would give the second earthbound check on the validity of Einstein's theory. It can be made because time can now be measured with an accuracy of fifty ten-trillionths of a second.

The variations caused by Einstein's theory would amount to only one second in every trillion. However, by using several maser clocks at both places, the test could be made now.

Within a few years, atomic clocks accurate to within one-tenth of a second for each quadrillion seconds should be developed. With such accuracy, one atomic maser clock in each location would be an easy test of Einstein's general theory of relativity.

The suggestion was made in Physical Review Letters, 16:662, 1966, by Dr. W. J. Cocke of Aerospace Corporation, El Segundo, Calif.

The first attempt to measure the effect of gravitational attraction on earthbound objects was made in 1960. Previous checks made only by astronomical observations have not shown the high precision some scientists would like.

The Einstein effect to be checked is known as the gravitat'onal red shift. It is a test of the principle of equivalence.

The equivalence principle is that no detectable difference exists between the force of gravity and the force produced by acceleration outside a gravitational field.

Another effect, also predicted by Einstein as part of his special theory of relativity and then made part of the general theory, could be tested by atomic maser clocks. This is the time dilation caused by the earth's rotation on clocks located at widely separated places on earth's surface.

Dr. Cocke's calculations show that the relativistic drifts cancel each other out, no matter how far apart the clocks are located on the surface.

• *Science News, 89:309 April 30, 1966*

PHYSICS

Heaviest Particle Yet Has Been Discovered

➤ THE HEAVIEST nuclear particle yet known has been discovered by five scientists using the accelerator at Argonne National Laboratory in Illinois.

The new particle is known as N* 3245. It is about three and one-half times heavier than the proton, the physicists reported in Physical Review Letters, 16:709, 1966. The proton and its uncharged counterpart, the neutron, are the two basic building blocks of all stable atomic nuclei.

Examination of the debris resulting from collisions of nuclear particles in Argonne's Zero Gradient Synchrotron revealed the existence of N*3245, so named because it is a resonance at an energy of 3.245 billion electron volts.

The discovery was made by Alan D. Krisch, John R. O'Fallon, Keith Ruddick and Steven W. Kormanyos of the University of Michigan and Lazarus G. Ratner of Argonne. Their research was supported by the U.S. Atomic Energy Commission and the Office of Naval Research.

• *Science News, 89:309 April 30, 1966*

TECHNOLOGY

Missile Guidance Simulator for Tests

➤ A NEW TEST RIG capable of finding out how accurately a missile homing device will stay on target under extremely adverse conditions is in operation at the Boeing Company Space Center at Kent, Wash.

Called an electro-optical guidance simulator, the test rig employs a complex chain of theatrical and aerodynamic elements to simulate tracking a target on a real mission.

It consists of a gimballed mirror, a precision zoom lens, a projection screen, a three-axis flight table and computer read-out. A tracking device is placed in the carriage of the three-axis table to simulate the aerodynamic characteristics of a missile: pitch, yaw and roll. Ahead of this is the rear-projection screen.

A slide is focused on the screen (the missile homer sees this as the strike scene) and as the run commences, a high-resolution camera lens zooms in on the slide at any speed from less than Mach one to Mach four, magnifying details of its landscape to 50 times the original size. When the zoom lens stops, a computer reads out the final position of the homing device in number of feet from the center of the target.

The 50-to-1 zoom ratio permits a missile simulation run against something the size of a truck to start at 15,000 feet and end with the missile 300 feet from the strike zone—so close that nothing can alter its straight-line course to impact. On larger targets, the run would start further out, but again would end in this same blind range.

Now, with a minimum of time and effort, haze, heat, foilage, camouflage, dust, atmospheric conditions and even some antimissile defense methods can be programmed into the test rig's computer to check the versatility and sensitivity of a missile homer. Instead of a homing device, a television camera can be mounted on the three-axis table to give military pilots experience in manually zeroing in on targets via a control stick and a closed-circuit console.

• *Science News, 89:309 April 30, 1966*

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