weakening of gravity. He told the meeting of the American Geophysical Union in Washington this week that the evidence comes from a study of the motions of the moon.

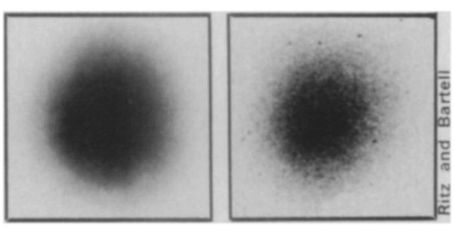
If gravity is weakening, the orbits of planets around the sun or of satellites around planets will expand, and the orbital period of these bodies will correspondingly increase. Some such expansion is provided by tidal forces in these systems, and the trick is to subtract out the tidal part and see if there is any left over.

Working with the calculations of two other observers, Van Flandern reports he has found there is an increase of four centimeters a year in the radius of the moon's orbit that is not accounted for by tidal action. "This is the first numerical result which appears to have as its most probable explanation that gravity is decreasing."

The amount of the decrease is about one part in ten billion per year. This leads to an increase in the lunar month (moon's orbital period) of about one two-thousandth of a second per year. It also means that a person weighing 70 kilograms would lose about seven millionths of a gram per year.

If Van Flandern is correct, the shock waves will reverberate, not only through cosmology but through all of physical science. Surely now there will be a number of observers poring over the orbital data of bodies in the solar system trying to confirm or reject Van Flandern's results. □

Photographing the insides of atoms



Neon, argon atoms at 500 million X.

Over the past century atomic physicists have built up a sophisticated theory of the structure of atoms based on indirect evidence, largely the light and X-rays the atoms emit. X-ray crystallography gave direct evidence for the existence of atoms, and in recent years electron microscopy has gotten overall images of single atoms (SN: 5/30/70, p. 524).

Now it is possible to look inside atoms, so to speak, to make images of the electron distribution within them. The apparatus that does it is a two-stage instrument at the University of Michigan in Ann Arbor that uses electron-microscopic techniques together with holography. It was designed by C. L. Ritz and L. S. Bartell. The achievement was reported at a symposium on molecular structure in Austin, Texas, in March.

They have obtained pictures of neon and argon atoms taken under conditions that show the electron distribution in the L shell (the second shell out from the nucleus) enlarged 500 million times. (Since the electrons are always in rapid motion, the distribution shows as a kind of haze.)

Already visual evidence of one piece of atomic-structure theory appears: Argon's L shell is only half the diameter of neon's. Theory expects this because the electric charge of the argon nucleus is twice as large as neon's. More such visual confirmations are likely to follow.

The idea for their apparatus goes back to a two-decade-old suggestion by Dennis Gabor, who won the 1971 Nobel prize in physics for the theory of holography. Gabor suggested using electron waves (electrons, like all physical particles, also behave as waves) to make a hologram of the electron distribution in an atom and then use optical techniques to make an enlargement of the holographic image.

To build the microscope Ritz and Bartell had to solve a serious problem in the making of an electron hologram, the provision of a reference beam. In making a hologram a train of waves that has been reflected from the object to be recorded is combined with a reference beam that has not been so reflected. The combination produces an interference pattern, which is recorded on film. If light is then later shone on this film it will reconstruct an image of the object.

But the reflected beam and the reference beam must be coherent—vibrate at all times in phase with each other. In the optical domain it took the invention of lasers with their extremely powerful coherent beams to make holography possible. How to provide an electron-reference beam in a world that lacks electron-wave lasers? Gabor didn't suggest.

But as they thought about the problem, it occurred to Ritz and Bartell that where pictures of an atom's electron distribution were wanted, the solution might be quite simple: In such a case an electron beam directed at an atom is multiply reflected. The electrons provide a weak reflection. A strong reflection comes off the nucleus of the atom. Why not use the reflection from the nucleus as the reference wave? Since it came from the same beam as the reflections from the electrons the necessity of coherence would be satisfied. They tried it and it worked. □

Conservation: Tigers or habitats?

Like so many paramedics evading battlefield crossfire to save the wounded, conservationists are learning the painful art of triage—how to rescue the salvageable while leaving the doomed to die. The process was dramatized last week as leaders of the World Wildlife Fund (WWF) confronted biologists from around the country in a meeting jointly sponsored with the Smithsonian Institution to assess the state of the conservation movement and to identify the crisis it is likely to face in the years ahead.

The challenge seems overwhelming. Speaker after speaker chronicled the demise of yet another species or habitat and spoke of "homogenization" of vast tropical jungles as an imminent event. In Indonesian Borneo, a new policy may allow lumber companies to cut practically all the trees below an elevation of 1,500 feet. "Slash and burn" agriculture follows the progress of trans-Amazonian highways, replacing virgin forest with crops until the fragile soil gives out in roughly three years, when useless scrub takes over. Japanese fishermen appear intent on driving various whale species into extinction, in a last desperate effort to find profit in an already dying business.

Against this global challenge stands a motley array of private and public ad hoc projects, funded at one end by less than $20 million from various United Nations programs, and at the other by groups such as WWF, which last year had only about $400,000 to devote to research. The meeting focused on how to use such limited funds more effectively in levering governments and industries into cooperation.

The lively debate, which took place in the secluded setting of a pre-Revolutionary estate owned by the Smithsonian Institution in Belmont, Md., divided roughly into two arguments: whether WWF and its sister organizations should jump into immediate action, purchasing land preserves and directly sponsoring the salvation of endangered species, or whether they should concentrate on conducting studies of problem areas and training professionals to handle the specific problems involved.

Championing the need for a new breed of conservation professionals is Yale professor F. Herbert Bormann, who likens the struggle to a military campaign. "The British Empire started at Sandhurst," he declares, and proposes foundation of a similar, practi-