

ponential attenuation of the original ultraviolet as it spreads out in space. The most important fluorescence emitter is the ion He II, whose lines account for the majority of spectral features.

At the same time that it creates the fluorescence, the original photon outburst also accelerates the gas in its path away from the center of the explosion and the motion imparted to the fluorescing atoms accounts for the line broadening and shifts. In the beginning, for kinematical reasons, most of the observed fluorescence comes from regions on the near side of the explosion, and thus arises the blue-shifted appearance of the spectrum. Later on, radiation from the far side will dominate, and the redshift will take over.

Solar telescope

A high-resolution solar telescope will soon be constructed to study high-energy proton showers associated with sunspot activity. Air Force Cambridge Research Laboratories will build the telescope at its Sacramento Peak Ob-

servatory in Sunspot, New Mexico, at a cost of \$3.2 million. It will feature a rotatable 98-meter interior tube containing the optical system and instrumentation under vacuum. The resulting elimination of air turbulence and dust will improve resolution. Researchers will attempt to predict periods of absence of proton showers, which are a potential hazard to men in space. Solar activities are also known to have a profound effect on the earth's weather and on communications and detection systems.

Slow relativistic electrons

The scattering of slow electrons by atoms is generally calculated by neglecting relativistic effects. However for heavy atoms, very slow electrons and certain simplifying assumptions, H. N. Browne and Ernst Bauer have recently shown that relativistic and nonrelativistic cross sections are quite different.

Browne and Bauer assumed that an atomic electron moves in a spherically symmetric potential produced by the nucleus and all the other electrons. This static central field approximation neglects both exchange and polarization effects resulting from the repulsive force between particles (here electrons) with identical spin and charge.

Comparing the relativistic and non-relativistic equations for each partial wave (in the partial wave expansion) Browne and Bauer found that the relativistic contributions to the first two terms of the equations decrease with decreasing energy, as one would expect. But the other relativistic terms in the equation tend to dominate with increasing atomic number and decreasing electron energy.

To see just how important these terms are, the authors calculated total scattering cross sections of helium, krypton, cesium and mercury at electron energies of 2, 20 and 200 eV. Relativistic effects increased with atomic number and decreased with

electron energy. At 200 eV the effects were a few percent but at 2 eV the relativistic cross sections were sometimes an order of magnitude different from nonrelativistic cross sections (either larger or smaller).

As one theorist explains, relativity is important at low energies because a small change in the wave function produces destructive interference, just as a small change in the thickness of a thin film produces destructive interference.

Although low-energy relativistic effects are pronounced in these scattering calculations, so is the low-energy variation of cross section with the potential used. The authors calculated mercury cross sections for example, assuming four different types of potentials: Hartree-Fock-Slater, relativistic Hartree, Thomas-Fermi-Dirac, and Thomas-Fermi. At 2 eV some cross sections differed by orders of magnitude. Browne and Bauer note that these results clearly demonstrate the need for better wave functions.

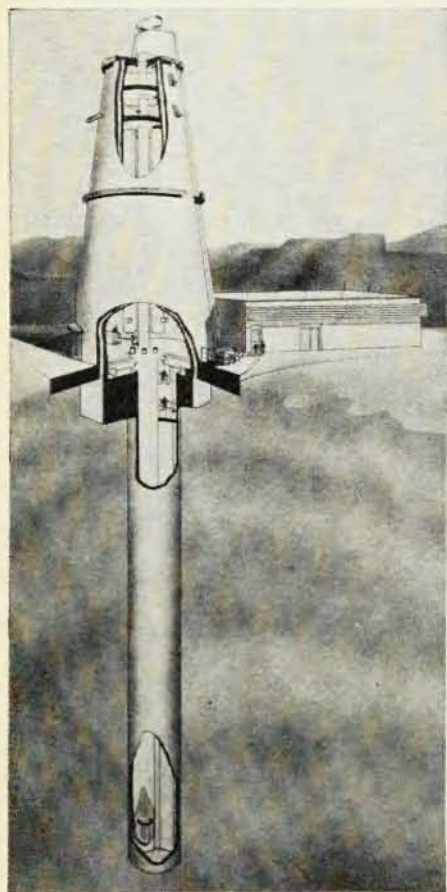
The authors conclude on a cautionary note to theorists: when calculating slow-electron scattering by heavy atoms, be sure to worry about relativity while you are worrying about exchange and polarization.

Browne and Bauer are at Michelson Laboratory, China Lake, California. Their work is reported in *Physical Review Letters*, 21 March 1966.

Neutron shape

Knowledge of neutron structure is in a little better shape due to recent measurements of electromagnetic form factors. Experiments with the Cornell electron synchrotron indicate that if the neutron has any charge density distribution at all it is probably very small.

The tool for neutron microscopy is a scattering reaction; the magnification is roughly proportional to q , the magnitude of the invariant 4-momentum given to the neutron in a reaction (q has units of F^{-1} since it varies inversely as de Broglie wavelength). By scattering electrons from a deuterium target the Cornell group probed the neutron's electromagnetic structure from $5.5 F^{-2}$ to $14.5 F^{-2}$ and, within experimental limits, the electric form



NEW SOLAR TELESCOPE at Sacramento Peak (artist's impression). Optical equipment will be contained in vacuum in the inside tube, which will be 98 meters long.