Atomic Spectra. Special effort has been continued to obtain extensive and homogeneous descriptions of selected spectra in the lanthanide group of rare-earth elements. This work forms part of the basic research that must be done for the preparation of Volume IV of “Atomic Energy Levels.”

The complex Ce spectrum has presented serious difficulties, but at last the analysis has been successfully started. From a study of strong lines observed in absorption, and from observations of the Zeeman effect, the ground state has been determined as \( 4f^6 6d^2 4G^e \) [1]. Several other low “odd” levels and more than 100 “even” levels are known. Additional measurements have been made from 4800 to 6100 Å, and selected Zeeman patterns are known to 7000 Å.

The Ce III spectrum has been observed and measured from 700 to 11 000 Å. Of the 2000 known lines, about 75% have been classified. The ground state is \( 4f^4 4I \) [2]. The strongest observed Ce III line, \( \lambda 6033.389 \) Å may be present in the solar spectrum, and account for a faint solar line at 3055.594 Å which has hitherto remained unidentified [3]. If correct, this identification provides the only evidence of a third spectrum among solar lines >3000 Å.

Methods have been devised for making electrodeless lamps without carrier gas. Experiments have been conducted for exciting and separating first and second spectra and for producing self-reversed lines. These have been used to help conclude the extensive descriptions of Pr I and Pr II spectra from 2000 to 9000 Å. Zeeman observations of these spectra made at the Argonne National Laboratory have been measured and reduced, thus furnishing the \( g \)-values urgently needed for the analyses [4].

The analysis of Pr III has been published [5]. The atomic spectra of thulium produced by microwave excitation of thulium-oxide, and by sliding spark discharges between pure metal electrodes, have been photographed from 2300 to 11 000 Å. Zeeman patterns have been recorded to 8000 Å. Some 10 000 lines will be included in a new description of Tm I and Tm II [2], [6].

Measurements and calculations of Zeeman patterns of 1307 lines characteristic of Yb I, Yb II and Yb III spectra have been compiled preparatory to publishing a new description of these spectra comprising more than 6500 lines [6].

A paper entitled, “The Atomic Spectra of the Rare Earths: Their Presence in the Sun,” summarizes the present state of progress on rare-earth spectra, and contains a long bibliography [3]. A more general reference summary is to be found in the Transactions of the Triple Commission for Spectroscopy held in September 1962 [7].

An extremely complete analysis of Br I is in press. This atomic spectrum stands out as one that has been most thoroughly observed and interpreted [8].

A theoretical paper on “Nonlinear Effects in the Spectra of the Iron Group” has been published [9].

Wavelength Standards. Work has continued on the measurement of interferograms of Kr* and Kr**. Progress is being made, also, with the development of emission sources for vacuum ultraviolet spectroscopy [10].

A new interferometric method has been used to study the hyperfine structure and isotope shifts of the Hg I line at 2537 Å [11]. The Zeeman-split absorption filter has been used with Hg* and the wavelength compared with that from a Hg** absorption beam [12], [13].

Spectroscopic Tables. Progress has continued with the derivation of experimental transition probabilities from the Monograph on Spectral Line Intensities. These data have been computed for some 25 000 lines of 70 elements [14], [15].

A new method has been developed for preparing computer data for publication. Programming codes have been written to control an automatic phototypesetting machine. This method has been used in the preparation of Monograph 53 [16].

The current revision of the 1928 edition of the solar spectrum is now partly in galley proof.

Work continues on the preparation of a new Multiplet Table.

The major advances since 1946 in standard wavelengths and intensities, in the quantum interpretation of atomic spectra, in spectroscopic apparatus, and in applications to chemical analysis, are discussed in a paper entitled “Review of Reviews of Atomic Spectra” [17].

The 180 MeV electron synchrotron has been used as a continuum light source for absorption spectroscopy in the region 180 to 470 Å. Two-electron transitions to states which autoionize have been observed.
in He, and transitions to ionized states have also been observed in Ne and Ar. In He ξ eight lines have been attributed to 1s\(^2\) 2s2p 2p\(^+\) and higher series members. In Ne ξ nine members of the series 2s\(^2\) 2p\(^+\) 2p\(^+\) have been detected, and in Ar ξ seven observed transitions probably may be attributed to 3s\(^2\) 3p\(^+\) 3p\(^+\) 3p\(^+\) [18].

The electronic structure of the Ne and Ar ξ bands has been studied in detail, and the analyses of the hyperfine structure have been completed for the principal transitions. The analyses have been extended to cover the principal transitions in the Ar ξ bands.

Calculations of the vibrational and rotational levels have been completed for the principal transitions in the Ne ξ bands. The results have been extended to cover the principal transitions in the Ar ξ bands.

The intensity of the extraterrestrial cosmic radio noise was observed on two frequencies at Palmer, Alaska, during the solar eclipse of July 1953. A technique has been developed which may lead to a determination of the cosmic radio intensity of the extraterrestrial radio noise.

A numerical calculation of the shape of the outer magnetosheath boundary and the auroral oval has been carried out for various solar wind pressures, and an investigation of the resulting geomagnetic field distortion is underway.

An investigation of the influence of magnetic storms on the motions of geomagnetically trapped particles has been made.

Analyses of data obtained by the "Aloha" satellite are expected to give information about the distribution of radionuclides in the outer atmosphere up to 1000 km.

Ionspheres of Other Planets. A theoretical study of the Martian atmosphere suggests that the Martian ionosphere occurs at a higher altitude than the terrestrial ionosphere.

Radiation observations of Venus were made at 50 MeV with the 30" balloon-borne apparatus during the Tenerife Optical and Radio Astronomical Observatory in November 1962. The relatively high signal-to-noise ratio made it possible to examine time variations in the returned signal of the order of tens of seconds [43]. Measurements of electron density out to two earth radii are continuing [44].

Terrestrial Aloha. A summary has been made of the night airglow data obtained during the IGY-IGC with particular emphasis on the physical intensity and behavior of the night airglow. This summary indicates that the night airglow is a complex phenomenon.

Calculations have been made which indicate that these mid-latitude red arcs are due to oxygen atom excitation by electrons which have been heated by local electric fields of the order of 1 millivolt per centimeter.

Advantages are advanced that the fields are generated in the magnetosphere during magnetic disturbances [46].

REFERENCES