

Books

The Galactic Novae. By Cecilia Payne-Gaposchkin. 336 pp. (North-Holland, Holland) Interscience Publishers, Inc., New York, 1957. \$8.50. *Reviewed by C. C. Kiess, National Bureau of Standards.*

The term New Star, or Nova in its Latin form, no longer carries with it its original meaning of a star newly created where none had previously existed. The only quality of newness it has is our acquaintance with it. It is now generally accepted by astronomers that Novae are really old stars, very old physiologically, which for some unknown reason have been rejuvenated, and after a brief splurge of glory, reckoned by days and not in cosmic time, settle down to a quiescent state, or, like old soldiers, fade away. The numbers of these stars, including the Supernovae also, are surprisingly small for a stellar population consisting of hundreds of millions of members. But enough factual knowledge about them has been uncovered during the past five or six decades to justify bringing it together and systematizing it for analysis and indicating the direction of further research. This is the goal set by the author of the book under review and she has attained it in admirable fashion.

The first three chapters give the important statistical details about dates and positions in the sky of the stellar outbursts and the variations in intensity and spectral composition of the radiated energy. The next three chapters give for individual stars the intimate details of their photometric and spectroscopic behavior during the period in which they were observed. Each of these chapters segregates the stars according to the amount of data available for them. In chapters 7 and 8 are discussed variable stars that resemble Novae qualitatively but with outbursts that recur at short, irregular intervals reckoned in days rather than in centuries or millennia. Chapter 9 deals with the Supernovae. As the name implies, these stars are Novae on a grander scale photometrically, their outpouring of energy during an outburst being 5 to 10 times greater than that of Novae. Spectroscopically they are difficult to interpret because they exhibit no characteristic emission or absorption features that can be identified with certainty. Their spectra are continuous but with distinctive distributions of energy that permit grouping them in two classes. In Chapter 10 the spectral changes that have occurred during the outbursts of several Novae are intercompared. These events are explosions on a large scale, the radiation of enormous amounts of energy being accompanied by the ejection of successive shells of stellar material that may eventually spread out into a diffuse nebula

surrounding the stellar remnant. In some respects they resemble the planetary nebulae. In the final chapter is given a "superficial survey" of the theories that have been advanced to explain the phenomena of Novae. In their efforts to find sources of energy responsible for these stellar explosions all of these theories have encountered objections difficult to overcome. Those making use of nuclear reactions and shock-wave phenomena offer the greatest promise of success.

This book is written for the specialist in astrophysics rather than for the general reader. Yet the latter may read parts of it with rewarding interest. If the specialist cannot find the information he wants in the book itself then he must look for it in the original papers that are listed in the extensive bibliographies appended to each chapter. In addition to these, indexes of subjects, of stars, and of authors cited in the text complete the book.

Now a few words about the mechanics of the book itself. It is the first in the new *Series in Astrophysics*, and its format and make-up presumably will be followed in succeeding volumes. The size and weight are commendable and make the book light enough to hold comfortably while it is being read. But the use of light-faced type on semiglossy paper imparts a lack of contrast to the printed page that makes for difficult reading in artificial illumination. A further hindrance to easy reading is the practice, now regrettably being adopted in various publications, of printing in parentheses and in type of the same size as that of the text, the dates of the bibliographical citations. When as many as eight such dates appear in a line it makes reading a hop-skip-and-jump performance that soon becomes fatiguing for one accustomed to take in several words at a glance. It is hoped that in future volumes of the series the editors will use numerical superscripts above the names of authors cited in the bibliographies.

Conference on the Physics of Cosmic Rays. Vol. 19, No. 5, 1955, of The Bulletin of the Academy of Sciences of the USSR—Physical Series. 109 pp. Translated by Columbia Technical Translations, White Plains, N. Y., 1956. Paperbound. Annual Subscription \$110; single issue \$20.00. *Reviewed by R. D. Sard and H. Primakoff, Washington University.*

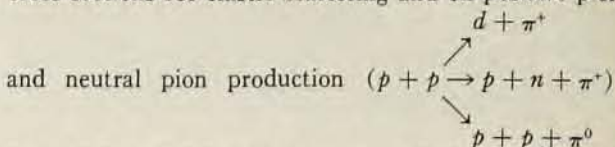
This translation of an issue of the *Izvestiia Akademii Nauk* of the USSR contains part of the proceedings of the "Third All-Union Conference in the Physics of Cosmic Rays" held in Moscow, December 15–23, 1954, under the chairmanship of S. N. Vernov. One gathers from Vernov's opening address that it was at this conference that Soviet work with accelerators (680-Mev synchrocyclotron under Mescheryakov and 300-Mev synchrotron under Veksler) was first revealed to the scientific public—as a result the conference proceedings not only contain much still valuable data but are of considerable historical interest. The issue is divided into two sections, the first devoted to experimental cosmic-ray work, at mountain altitudes and higher, the second devoted to a description of the synchrocyclotron experi-

ments on nucleon-nucleon elastic and inelastic (pion production) interactions. The translation is uniformly excellent.

In the first contribution, Vernov, Grigorov, Zatsepin, and Chudakov summarize their balloon experiments at different latitudes using hodoscoped Geiger counters and pulse ionization chambers. The technique is impressive; for example, the ionization chambers detect single minimum-ionization particles. The results form a valuable contribution to the determination of the effects of the earth's atmosphere on the cosmic radiation. They are presented, however, as the basis for conclusions about the nucleon-nucleon interaction in the range 10^{10} – 10^{12} ev. The reasoning is ingenious and plausible, but involves so many steps that the conclusions can only be regarded as suggestive. Earlier data not differing greatly from these led to very different conclusions about the elementary process (Suppl. No. 4 *Nuovo Cimento* 10, 489, 1953). The second paper by Baradzei, Rubtsov, Smorodin, Solov'ev, Tolkachev, and Tulinova describes shower observations with a small magnet cloud chamber at 9 km (presumably in an airplane), the shower being produced in a beryllium plate by charged particles. The results are essentially distributions with respect to number and angle, the sign of charge and the momenta being only rarely measurable. The third and fourth papers, by Kocharian, Saakian, Aivazian, Kirakosian, and Aleksanian ($\equiv$ Alikanian?) report some measurements made with the large magnetic spectrometer of the Armenian Academy of Science. Momentum spectra of negative pions and of protons produced in graphite by neutrons are presented, as well as a spectrum of the protons in the atmosphere at this height (3200 m). In the fifth paper, Rapoport describes the balloon-borne pulse ionization apparatus already referred to, and shows ionization spectra of the hard and soft components at various altitudes up to 26 km. Kotenko reports measurements of pulse height spectra in stilbene and naphthalene for particles of various ranges, the counterpart at 3200 m of Bower's concurrent measurements at Chicago, with the same results. Ageshin, Charakhch'ian, and Charakhch'ian measured with balloon-borne Geiger tube telescopes the range distribution of short-range particles as a function of altitude, finding an apparent excess of particles of range $1\text{--}2\text{ g cm}^{-2}$ Al near the top of the atmosphere. The same authors also sent up an assortment of Geiger-tube shower selectors reminiscent of the early nineteen thirties, and conclude that there are narrow photon showers in the stratosphere. Takibaev of the Kazakh Academy of Sciences presents results on black and grey tracks from stars originating in fine wires of tungsten, copper, and aluminum imbedded in nuclear emulsion and exposed at mountain and balloon altitudes. Birger, Guseva, Zhdanov, Slavatinski, and Stashkov contribute an abstract on work done at 4 km altitude with a magnet cloud chamber containing a plate of beryllium and Zhdanov and Fedotov an abstract on an emulsion study of the air-lead transition at 5 km.

The remaining papers describe results obtained with the 680-Mev synchrocyclotron and the 300-Mev syn-

chrotron. Mescheryakov, Bogachev, and Neganov as well as Nikitin, Selektor, Bogomolov, and Zombkovski study the proton-proton interaction in the region of 460–660 Mev. Data is given on differential and total cross sections for elastic scattering and on positive pion



A careful and elaborate discussion of the experimental technique and of the sources of error is included and various elegant detection devices are described (e.g. use of conjugate telescopes of proportional counters in coincidence for detection of scattered and recoil protons). The data agree well with expectations based on experiments performed in this country at lower and at higher energies—in the ≈ 500 -Mev energy region the p - p elastic differential cross section first becomes angularly anisotropic and the pion production first begins making appreciable contributions to the total p - p cross section.

Dzhelepov, Kazarinov, Golovin, Fliagin, and Satarov present an experimental investigation of the interaction of neutrons with nucleons and with deuterons at energies in the 380–590-Mev region. The high-energy neutrons are obtained from proton bombardment of Be^9 (forward neutron projection); in the n - p , n - d scattering experiments the scattered neutrons are observed either indirectly by detection in a coincidence scintillation counter telescope of the charge exchange protons or directly in a Bi fission chamber. Alternatively the recoil protons from the n - p collisions are observed in a coincidence proportional counter telescope. The results obtained for the differential and total cross sections of the processes: $n + p \rightarrow n + p$; $n + d \rightarrow n + d$; $n + d \rightarrow p + n + n$ together with the previously mentioned results on $p + p \rightarrow p + p$ are consistent with the validity of charge symmetry and charge independence in the nucleon-nucleon interaction and show among other things that in the 400–600-Mev region, 1) the n - p space exchange and ordinary forces are roughly equal, 2) the spin-exchange and spin-nonexchange forces participate about equally in the charge-exchange nucleon-nucleon interaction and, 3) the isobaric triplet and isobaric singlet nucleon-nucleon interactions are quite different, the latter decreasing substantially with increasing energy (up to 590 Mev).

The next paper, by Kozodaev, Tiapkin, Baiukov, Markov, and Prokoshkin, deals with the production of neutral pions by high-energy nucleons—in particular, incident protons in the energy region 470–670 Mev are used. γ rays arising from the decay of the neutral pions are observed in a multichannel pair spectrometer employing positron and electron proportional counters in coincidence; in this way γ -ray energy spectra are obtained. The results indicate that the neutral pions are predominantly produced on the surface of nuclei ($\sim A^{1/3}$ law)—data is also obtained on the energy and angular dependence of π^0 production in various target elements.

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The issue closes with a brief theoretical paper by Baldin on the isobaric invariance of the pion field and with concise but informative abstracts on the photoproduction of neutral pions on deuterons (300-Mev synchrotron: Belousov, Kutsenko, and Tamm), on the photoproduction of charged pions on hydrogen and deuterium (300-Mev synchrotron: Adamovich, Kuz'micheva, Larionova, and Kharlamov) on the investigation of the (γ, p) reaction at energies under 30 Mev (30-Mev synchrotron: Leikin, Osokina, and Ratner) and on the yield and angular distribution of high-energy photoneutrons (Baranov and Gol'danski).

Electricity and Magnetism. By B. I. Bleaney and B. Bleaney. 676 pp. Oxford U. Press, New York, 1957. \$10.10. Reviewed by T. Teichmann, Lockheed Missile Systems Division.

Recent works on electricity and magnetism have tended mainly to extended treatments of Maxwell's electromagnetic theory together with applications to rather fundamental physical phenomena such as the scattering of electromagnetic waves, radiation from moving charges, etc. Such a treatment certainly establishes a sound basis for the understanding of electromagnetic phenomena, but it nevertheless leaves a substantial gap, at least in the expository sense, between this basis and many of the practical phenomena which it underlies. This gap is largely bridged by the volume here reviewed which not only expounds the underlying material in a concise but perspicuous way, but contains a wealth of interesting and significant applications. The book begins with a study of electrostatics, steady currents, and conductors including frequent references to and discussions of significant experiments and methods of measurement. Aside from the standard material, consideration is given to such topics as Drude's theory of metallic conduction, electron optics, thermoelectricity, electrochemical potentials, and gaseous discharges. This is followed by chapters on magnetostatics, electromagnetic induction, direct current measurements, and magnetic measurements. In conformity with the authors' well-known interests, particular emphasis is laid on the last-mentioned topic. The general portion of the book concludes with chapters on alternating current theory and electromagnetic waves. The remainder of the book deals with a variety of topics covering the entire gamut of electromagnetic problems, though again with an accent on the authors' own interests in the field of magnetism. The subjects covered are filters, transmission lines, waveguides, electric machinery, vacuum tubes and their applications, very high-frequency tubes, alternating-current measurements, noise theory, dielectric constant, solid-state conduction theory, paramagnetism, ferromagnetism and antiferromagnetism, and magnetic resonance. Each chapter is followed by a set of reasonably simple but illuminating problems together with their answers. The rationalized mks system is used throughout but the final chapter is devoted to translating the important results into the cgs and the practical systems.