Book Reviews

Success Story

The Evolution of Radio Astronomy. J. S. HEY. Science History (Neale Watson Academic) Publications, New York, 1973. x, 214 pp., illus. $8.95.

If radio astronomy had a golden age, it started in 1945 and ran for about a decade, by which time the main branches of the subject had been defined. This is not to say that everything since then has been in the nature of follow-up; on the contrary, astonishing discoveries—quasars and pulsars, for example—have continued to be made and to have a profound impact on our understanding of astrophysics, cosmology, and physics. Indeed, there have been many recent years when the discovery of the year in physics has been in radio astronomy. But the flavor of things in that first decade was unique. It has been recreated for us by J. S. Hey in an interesting and readable book. Hey's claim to eminence in radio astronomy is that he was associated with discoveries from which sprang three distinct branches of the subject. He recalls the tense days of the Battle of Britain, the escape of the *Scharnhorst* and the *Gneisenau* through the English Channel under the cover of jamming from the French coast that blinded the coastal radar, and the apprehension caused by the apparent resumption of jamming at sunrise on 27 and 28 February 1942. Hey immediately identified the sun as the source of this interference, clinching his conclusion by ascertaining from the Royal Observatory at Greenwich that an exceptionally active sunspot was on the central meridian on 28 February. Later, in 1945, he identified a phenomenon previously known to ionospheric physicists as "short scatter," demonstrating by convincing experiments involving three sites and the radar equipment that had been developed to track the V2 rockets that ionized trails of meteors were responsible. In a separate project in 1946 to repeat Reber's mapping of the cosmic radio radiation, time-variable behavior was noted, traced to the constellation Cygnus, and located to within about 2 degrees. Hey, and his associates Phillips and Parsons, concluded that a discrete, localized source must be responsible. Thus the famous extragalactic source, later to be named Cygnus A by Bolton, was discovered.

Each of these discoveries was rapidly followed up, in each case by more than one group, and we learn of the background of these groups, the people in them, and the way in which the studies developed and interacted. Many interesting case histories unfold, possibly with lessons that might guide others aspiring to notice and pursue fruitful lines of research. Many other discoveries are traced from their origins, for example moon radar, lunar emission, the hydrogen line, and the cosmic background radiation, always with anecdotal detail that is well known to the early participants in radio astronomy but cannot easily be found in print.

As the book proceeds, related theoretical and instrumental developments such as synchrotron radiation and interferometry are also dealt with historically. The goals and modes of thought of that band of pioneers—they did not think of themselves as radio astronomers—are clearly presented. One sees their strategies for extracting the answers from nature as quickly as possible, under difficult constraints of equipment, but spurred by competition with their counterparts in other countries. The productivity inherent in open publication in international journals has been well exhibited in radio astronomy. In those days the design of the observation and the design of the instrument were closely linked; slowly, however, the time and cost of equipment construction expanded beyond recognition.

Representative current radio telescopes are described, in addition to the successive generations of ingenious instruments that led to them; in fact the book is quite up-to-date on this subject. At one time, survey papers on radio telescopes were out of date by the time they appeared; but long lead times, approaching a decade for instance in the case of the Very Large Array now under construction by the National Radio Astronomy Observatory, have changed this.

A good part of the book is devoted to the current state of the main branches of radio astronomy, and although no topic is treated exhaustively, there is factual material about nearly everything. The range of topics is impressive, extending from how to detect point sources by the scintillation introduced by the solar wind, through the better-known divisions of radio astronomy, and on to flare stars, red giants, x-ray stars, and other sorts of stars that emit radio waves. As with other parts of the book, this material is compactly and interestingly written, is provided with literature references, and is the best broad survey at present available.

Radio astronomy had its fiascoes; numerous wrong ideas were published and sometimes tenaciously held for years. Gradually the papers cease to be referred to, but the actors of the time do not forget them and will happily oblige to this day with details of colossal blunders made by others. I believe these conflicts of ideas played an important role and one that could be brought more sharply into focus by an author willing to write with the frankness of J. D. Watson in *The Double Helix*. Hey treats these aspects very gently, even when relating Appleton's "incursion" into his own team's research findings.

Hey worked within the Army Operational Research Group, which is where operational research, now a household phrase, began. He gives interesting comments on the virtues of military research establishments and on the virtues of radio astronomy, encompassing as it does "branches of experimental and theoretical physics, astronomy, electronics and engineering, computing and statistical analysis . . . organization and operation of systems, and working in collaboration with others," for training graduate students. Radio astronomers will enjoy this book, as will graduate students in the sciences, and it is well within the range of high school science students.

R. N. BRACEWELL
Radio Astronomy Institute,
Stanford University,
Stanford, California