

Violence on the radio waves

Cosmic Noise

A History of Early Radio Astronomy

Woodruff T. Sullivan III
 Cambridge U. Press, New York,
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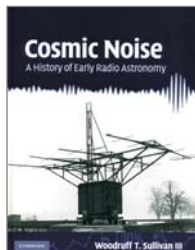
Reviewed by Marshall H. Cohen

In August 1931 Karl Jansky at the Bell Telephone Laboratories in New Jersey recorded the first measurements of cosmic noise—radio waves from beyond Earth—while he was studying atmospheric interference. A year and a half later, detailed analysis of the interference showed that it had a component that moved with the stars. Thus was born radio astronomy, although the term was not used until many years later.

Astronomer and historian Woodruff Sullivan tells that story and dozens of others in his marvelous book, *Cosmic Noise: A History of Early Radio Astronomy*. The story begins in 1890, shortly after Heinrich Hertz demonstrated the existence of electromagnetic waves. Thomas Edison and his assistant Arthur Kennelly were corresponding with Edward Holden, the director of the Lick Observatory in California, about using an iron-ore-filled mountain in New Jersey as the core of an induction coil to receive radio waves from the solar corona. It is not clear whether that experiment was ever tried. Over the next two decades, several European scientists attempted to detect solar radio waves, but all were unsuccessful. After Jansky's discovery, the quest was revived by a talented and curious radio engineer, Grote Reber, who in 1937 built a 9.5-meter parabolic reflector in his family's backyard in Wheaton, Illinois, and used it to observe the Milky Way and the Sun.

It was clear from Jansky's and Reber's work that the radio sky was

drastically different from the optical sky. Yet no one foresaw the cornucopia of riches that would follow: daytime meteors, a hot solar corona, many varieties of solar bursts, hot and cold interstellar material and, after 1953, quasars, interplanetary and interstellar scintillations, pulsars, gravitational waves, and the cosmic microwave background radiation, to name a few. The old, orderly world of stars and galaxies has been replaced with a complex and violent universe, and radio astronomy, followed by investigations at shorter wavelengths, has led the way to this new view of the cosmos.



The early studies by Jansky and Reber actually had little influence on post-World War II developments, which were driven by wartime radar work. In 1945 four major research groups were established. Three were in England, the earliest being a reorganization of Stanley Hey's wartime research team; that group returned to military work in 1948, when the cold war began to heat up. The other groups in England were headed by Martin Ryle at the University of Cambridge and Bernard Lovell at the University of Manchester. The fourth major group was established by Joseph Pawsey at the Radiophysics Laboratory of the Commonwealth Scientific and Industrial Research Organization in Sydney, Australia. Sullivan devotes a chapter to each of those groups, giving full details of their founding, their instrumental developments, and their scientific discoveries. He also covers the smaller radio observatories that were set up after the war.

Sullivan includes a thorough discussion of the early theoretical work, largely in the Soviet Union, to understand cosmic noise. Because that work remained untranslated, it was not fully appreciated in English-speaking countries for many years. Sullivan discusses the well-known story of Dutch astronomer Hendrik van de Hulst's theoretical study of the 21-centimeter neutral hydrogen line (used extensively in astronomy) and of the race for its discovery between Harvard University

and the University of Leiden in the Netherlands. Sullivan debunks the common myth that Leiden lost the race because of a fire and even suggests that the change in personnel hastened by the fire may have aided the Dutch efforts.

The book concludes with several chapters on the sociology of radio astronomy, its relation to optical astronomy, and national differences. Why was radio astronomy weak in the US, given the huge wartime radar program? Sullivan suggests two factors: the US military's strong push for higher frequencies above those commonly used during the war, even though their exploitation was greatly hindered by lack of instrumentation, and the reluctance of US optical astronomers to fully appreciate the radio work.

Cosmic Noise carries the history of radio astronomy up to 1952–53, roughly the end of the pioneering era and the beginning of large-scale projects. It is a huge book, well written and extraordinarily thorough, and it contains everything you might want to know, and more. For example, the great soprano Joan Sutherland worked as a typist at the Australian Radiophysics Laboratory during World War II. Sullivan has dug very deep to put this book together. Students, researchers, and historians of science interested in radio astronomy will want to read *Cosmic Noise* to get a definitive history of the field.

Glimpses of Creatures in Their Physical Worlds

Steven Vogel
 Princeton U. Press, Princeton,
 NJ, 2009. \$75.00, \$35.00 paper
 (302 pp.). ISBN 978-0-691-13806-0,
 ISBN 978-0-691-13807-7 paper

"Evolution cannot escape its earthly context . . . nor can it meddle with mathematics," writes Steven Vogel in his introduction to *Glimpses of Creatures in Their Physical Worlds*. Therefore, the design of organisms reflects their physical context, in which are applied the very same principles of gravity, inertia, and heat transfer, and the same properties of fluids and

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