

An inside story of the NRAO

Open Skies: The National Radio Astronomy Observatory and Its Impact on US Radio Astronomy.

Kenneth I. Kellerman, Ellen N. Bouton and Sierra S. Brandt (Springer, Cham, 2020). Pp. xxiv + 652. ISBN 9783030323455. Open access at <https://link.springer.com/book/10.1007/978-3-030-32345-5>.

Open Skies provides a welcome addition to the history of radio astronomy¹ with a detailed study of the establishment, history and influence of the United States's National Radio Astronomy Observatory (NRAO). It does this both within an international context and from a US perspective, dealing not only with instrument development and observational techniques but also the politics associated with establishing a national facility, including competitive funding, managing large-scale projects, and, importantly, developing the open access policy to which the book owes its title. This policy has been instrumental in shaping the field of radio astronomy.

With their extensive experience and deep involvement in the field, the authors are uniquely qualified to narrate this story. With over 60 years in radio astronomy and more than half a century at the NRAO, Kellerman played a pivotal role in developing Very Long Baseline Interferometry. Bouton, who has dedicated over 40 years to the NRAO, first as Librarian and then as NRAO Archivist for the last 16 years, has facilitated the detailed reconstruction and referencing of events through her work with the archive. Brant, a historian of science, has been working with the NRAO Archives for the past 8 years, further enriching the narrative with her expertise.

Radio astronomy effectively started in the US in 1933 with Karl Jansky's discovery of radio emission from the Milky Way, but apart from the solo efforts of Grote Reber, US scientists did not immediately seize the opportunity presented by the opening of this new observational window on the universe. In the post-war period, other countries began to actively explore the radio sky, taking advantage of the technology and expertise gained during the development of radar during WWII. This led to an explosion of discoveries, major observation programmes and instrument developments, particularly in the UK and Australia. The perception that US science was falling behind in this new field set the scene for the birth of the NRAO in the early 1960s.

The authors' meticulous research is evident in the detailed descriptions of crucial radio astronomy projects and technological advancements that have propelled the NRAO to the forefront of radio astronomy research. Rather than following developments in strictly chronological order, the authors craft a series of themed chapters. They begin with a summary of Jansky's initial discovery through to the post-war international boom in radio astronomy when the US started to fall behind, followed by a thorough discussion of events leading to the establishment of the NRAO, its initial growing pains and ultimate maturity and challenges. This includes the important topic of developing the Open Skies policy adopted by the NRAO. A series of chapters then deal with the NRAO's involvement in the search for extraterrestrial intelligence (SETI), the development of the

Very Large Array (VLA) and Very Long Baseline Interferometry (VLBI), large steerable telescopes and millimetre wavelength radio astronomy. The final chapter deals with the NRAO in the 21st century.

Although celebrating the triumphs, the book does not shy away from addressing the challenges and controversies that have shaped the NRAO's trajectory. The authors provide a well-rounded view of the observatory's contributions to US radio astronomy, acknowledging successes and setbacks. In contrast to some other histories² that have focussed on the generally collaborative approach of radio astronomers, the authors provide detailed examples of the, at times, intense competition and less than professional behaviour of scientists, most notably in the establishment of millimetre-wave radio astronomy in the US. The examples discussed of competition for funding between universities and national facilities also highlight the contest between funding new facilities or developing new researchers in radio astronomy. There are many lessons to be learned from this history, particularly in project management and the development of significant new instruments.

In conclusion, *Open Skies* is an enlightening journey through the history of the National Radio Astronomy Observatory, showcasing its instrumental role in shaping the landscape of radio astronomy in the United States. The authors deliver a compelling narrative celebrating scientific achievements and inviting readers to contemplate lessons learned. This book is a must-read for anyone captivated by the intersection of science, technology and the development of modern astronomy.

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Notes

1. Early radio astronomy in the USA up to 1953 has been well covered, especially by W.T. Sullivan, *Cosmic Noise* (Cambridge: Cambridge University Press, 2009), reviewed in this journal, 44 (2013), 109–110.
2. For example, D.P. Munns, *A Single Sky: How an International Community Forged the Science of Radio Astronomy* (Cambridge: MIT Press, 2013), reviewed in his journal by Woodruff Sullivan, 45 (2014), 483–5.