

Book Review

By: Whitham D. Reeve

Title: *The Invisible Universe – The Story of Radio Astronomy, 2nd Edition*

Author: Gerrit L. Verschuur

Publisher: Springer Science+Business Media

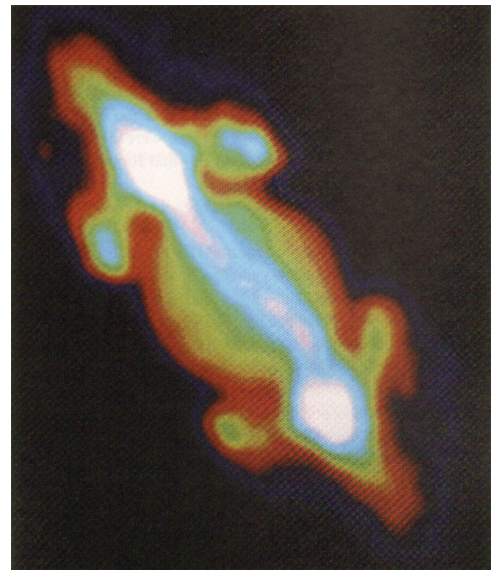
Year published: 2007

Cost: US\$17 to US\$25 plus shipping (used or new)

My last review covered a series of books published in the 1960s – the Van Nostrand Commission on College Physics Momentum Books. I will return to a more current time with the review of *The Invisible Universe*. It was first published in 1974 and the newer 2007 edition is the third rewrite (but is the 2nd edition). The author explains that in 1973, when the first edition was written, “*it was possible to summarize all of radio astronomical discoveries in fair detail in a single monograph without overwhelming the reader.*” However, over the intervening years much has changed in radio astronomy. Because of the sheer volume of information and advancements, the author says “*it is no longer possible to provide a comprehensive overview*”

That warning explains the brevity of this book. This is no encyclopedia nor was it intended to be. The book contains 156 pages with 16 short chapters of two to nine pages each. Each chapter is broken into short numbered sections, many consisting of only one paragraph. The index is an adequate five pages. I found it curious that there are no charts or graphs with numbers on them.

The book has many photographs and color images, which the author calls "radiographs". The images mostly are color gradient intensity maps of celestial radio objects, some quite interesting and pretty (at least to a radio astronomer) but of the type you find in a popular magazine. Many of these images have little explanation other than to name the object. Often the text contains more detailed explanations than the caption. The image to the right is from Fig. 3.1 and is a radiograph of Jupiter made with the Very Large Array near Socorro, New Mexico. There is no indication of frequency and no scale to indicate the relative intensity of the radio waves or to correlate colors with intensity. I assume red is 'hot' and blue and white are 'cold'. Or is it the other way around? It looks somewhat like a tailless lizard.



The Invisible Universe contains a 7-page appendix with short explanations of topics like “Seeing” Radio Waves, The Brightness of Radio Sources, and The Redshift and Doppler Effect. I think the short explanations would have been more useful in the main body of the book where the topic is first encountered.

This book contains no references nor does it include recommendations for further reading or for pursuing further study. This raises the question: Who is this book for? I have no idea for whom this book was written but I think it was not for the reader who wishes to get a quick overview and then pursue the subject in more detail. If it was, the author would have provided at least a

bibliography for further reading and study. Perhaps it was written for someone like a student, who was told to write a report on radio astronomy but who has no further interest in the subject. Perhaps it was written to read on the airplane while taking a trip and then discarded.

This is a non-technical book. As a quick and very simple overview of radio astronomy, it gets a passing grade. But if you are looking for anything more than a superficial review, you are not going to find it here.

My library is full of “the stories of radio astronomy.” Almost all were written by pioneers in the field of radio astronomy. In my opinion, having personal accounts by the people who actually were there always is more interesting than stories written by later researchers who pick and choose the history and already-published details they want to include in their book. Of course, those original authors also do the same but I would rather hear the story from them.

Gerrit Verschuur is no stranger to radio astronomy, but I had not heard of him before obtaining *The Invisible Universe*. He has written a half-dozen books on various aspects of radio and optical astronomy. Some appear to be doomsday books with titles like “Cosmic Catastrophes” and “Impact!: The Threat of Comets and Asteroids.” I have not read any of his other books. His credentials date back 50 years. Wikipedia has this to say of his current research: “*Verschuur is at the center of a recent debate over the age of the universe. He claims that images from the Wilkinson Microwave Anisotropy Probe (WMAP) are not pictures of the universe in its early form, but rather hydrogen gas clouds in our own galaxy. If he is shown to be correct, much work relating to the Big Bang Theory would be undermined.*”

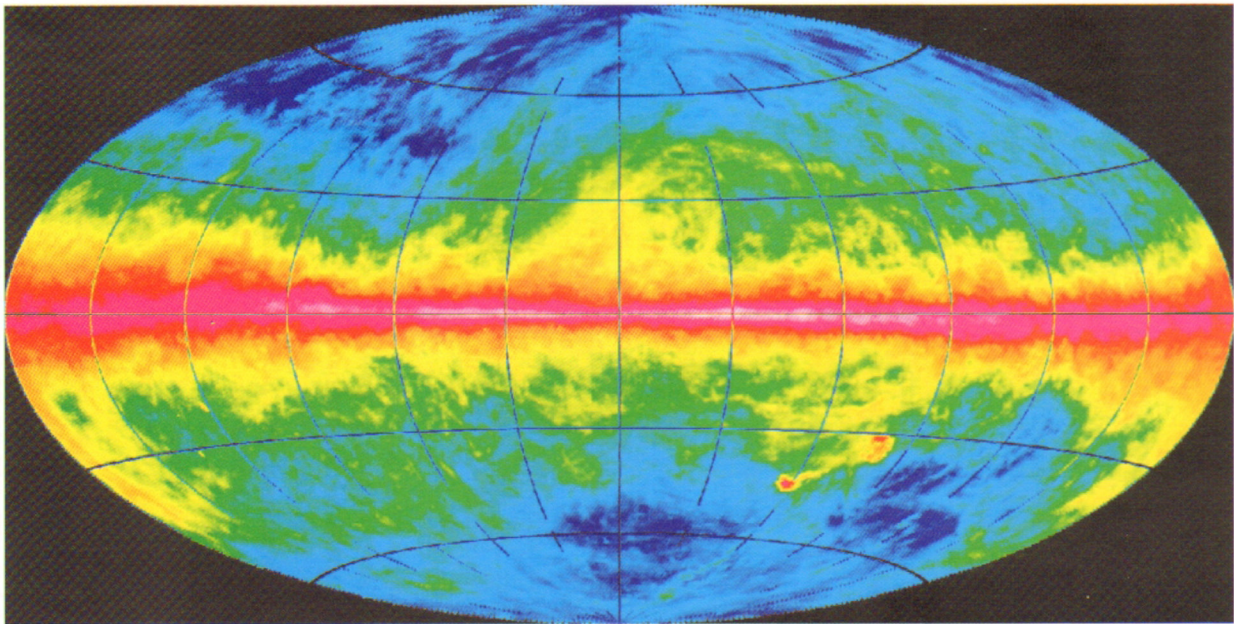
The Invisible Universe is punctuated by numerous sidebars (anecdotes) relating the author’s personal experiences in radio astronomy. I like reading personal accounts but, in this case, I feel some of them (in particular, one over a page long on an early fax machine the size of a refrigerator, but there are others) could have been replaced by more detailed explanations of celestial radio phenomena or eliminated altogether.

An examination of the table of contents reveals that Verschuur provides a comprehensive list of celestial radio sources. I found this list to be quite useful – for the first time I saw in one place all the radio stuff that goes on out there. Unfortunately, for the most part, the chapters themselves were of less value to me. The table below lists the chapters and their titles and lengths.

Chapter	Title	No. pages
1	What is Radio Astronomy	7
2	A Science is Born	7
3	The Radio Sun and Planets	6
4	The Galactic Radio Nebulae	6
5	Radio Waves from the Milky Way	9
6	Interstellar Hydrogen	5
7	Interstellar Molecules	8
8	Pulsars	9
9	The Galactic Superstars	7
10	Radio Galaxies	2
11	Quasars	3
12	The Grand Unification: Active Galactic Nuclei	8
13	Beyond the Quasars – Radio Cosmology	7
14	On the Radio Astronomical Quest for Extraterrestrial Intelligence	1
15	Radio Telescopes: The Future	8

Of particular interest to many amateur radio astronomers is the detection of emissions from neutral hydrogen in the interstellar medium. This is the so-called 21 centimeter spectral line, or hydrogen line with the symbol HI, at about 1,420 MHz. Describing the efforts to make an all-sky survey of the hydrogen line and completion of this survey around 2005, the author says in a sidebar *“Had I attempted a similar survey back in 1962 with the equipment available to me then, it would have taken 10,000 years to complete the project! This stunning difference is in part due to a factor of 100 improvement in receiver sensitivity, 1,000 data channels as opposed to one, and of the number of directions (400,000) that had to be observed.”* As readers, we now realize the technical difficulties associated with professional radio astronomy and that technology, more than anything, has enabled our discoveries.

Theoretical calculations by Dutch scientist Henk van de Hulst during World War II predicted that neutral hydrogen would emit radio waves as the constituents of the hydrogen atom change states. It was thought these emissions could be detected by radio telescopes on Earth. The importance is that HI is the signature of the early beginnings of the universe before stars started to form and mapping it helps us understand that beginning. After the war ended, several attempts were made to detect HI, but it was not until 1951 when receiver technology had finally improved enough and investigators had success. Two investigators, H.I. Ewen and E.M. Purcell at Harvard in the USA, were the first to detect it. Shortly afterwards, investigators in Australia and The Netherlands also detected the emissions. Over the intervening 50 years, much work has been done, resulting in an all-sky HI map shown in chapter 6 (below, from Fig. 6.1). This image is notable not only because it has very interesting dark areas, spurs and filaments, but also because it is one of the few in this book with a detailed caption.



The author spends some time in chapter 14 on the quest for extraterrestrial intelligence – SETI. He was actively involved in it in the early 1970s. One section of this chapter is titled "The Harsh Realities of the SETI Equation – A Modern Heresy" in which he picks apart the method frequently referenced for calculating the likelihood of civilizations like ours in the Milky Way

galaxy – an equation, also called the Drake Equation, with eight factors. He says "*This simple equation summarizes a stunning amount of unknown information*" and goes on to use various values for the factors. His calculations vary from 1 civilization in every 100 galaxies to 1 in 100 billion galaxies. Verschuur admits he is "*a born-again skeptic about the value of the SETI program*"

In the final chapter, the author provides a mixture of philosophy and reality. In one section he asks "How Much Longer will Radio Astronomy Last?" This question is related to the radio equivalent of light pollution experienced by optical astronomers – radio interference. Most amateur radio astronomers can relate to this problem, and it most likely will not improve with time. The author offers no solutions.

In conclusion, the value to me in *The Invisible Universe* was the list of celestial radio sources in the table of contents and the subsequent brief descriptions – they filled in a few gaps in my thin knowledge of radio astronomy. My main complaint is I had nowhere to go after finishing the book. I did find that the more I read, the more I got used to the simple descriptions. I found myself pulling more out of them in a reverse sense by searching through my other references. If the author's objective was to write a book on radio astronomy limited to 156 pages, he met that objective. If it was to provide a stepping stone for further study of celestial radio phenomena, I do not believe that objective was met and a reader expecting that will be disappointed.

Biography – Whitham D. Reeve

Whitham Reeve was born in Anchorage, Alaska and has lived there his entire life. He became interested in electronics in 1958 and worked in the airline industry in the 1960s and 1970s as an avionics technician, engineer and manager responsible for the design, installation and maintenance of electronic equipment and systems in large airplanes. For the next 37 years he worked as an engineer in the telecommunications and electric utility industries with the last 32 years as owner and operator of Reeve Engineers, an Anchorage-based consulting engineering firm. Mr. Reeve is a registered professional electrical engineer with BSEE and MEE degrees. He has written a number of books for practicing engineers and enjoys writing about technical subjects. Since 2008 he has been building a radio science observatory for studying electromagnetic phenomena associated with the Sun, Earth and other planets.

