

Title: ***Making Waves ~ The Story of Ruby Payne-Scott: Australian Pioneer Radio Astronomer***

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Reviewer: Whitham D. Reeve



***Making Waves*** is an abbreviated, partly rewritten version of ***Under the Radar ~ The First Woman in Radio Astronomy, Ruby Payne-Scott*** published in 2010. ***Under the Radar*** is a very expensive hardcover book (259 USD in May 2015) also published by Springer. I am not familiar with the original but the version reviewed here, according to the back cover, “addresses a general readership interested in historical and sociological aspects of astronomy and presents the biography of Ruby Payne-Scott (1912~1981)”. I have a hunch that Springer sees an expansion of the general radio astronomy publishing market and wants a piece of the action, so it is making some existing books more accessible (that is, cheaper and easier to read). Unfortunately, Springer missed the price mark on this one, but it still is a pretty good book. I know of another Springer project to rework and improve a very poorly edited RSGB book on amateur radio astronomy that I reviewed in late 2011, but I have not yet seen its price.

***Making Waves*** has two main themes, early post-WWII radio astronomy, particularly in Australia, and women's rights (or lack of them) in Australia during the same period, particularly Payne-Scott's. The book is well-cited and draws heavily on official correspondence, interviews and first-hand information provided by Payne-Scott's coworkers, friends and family. There is almost as much information in the footnotes as in the main text, so the reader needs to jump back and forth. Nevertheless, ***Making Waves*** is easy to read and quite interesting even for readers interested in only one or the other themes. This is not a heavily illustrated book but it does include line drawings and photographs that add to the text.

I heard about ***Making Waves*** on the Yahoo group used by the Astronomical Society of Victoria – Radio Astronomy Section (ASV-RAS) in Australia. Before ordering the book, I did not recognize the name Ruby Payne-Scott. I saw that she was an Australian, and I did know that Australians contributed heavily to early post-WWII radio astronomy. After reading the book, I looked through my library and found several early radio astronomy books that mention her by last name only, including one by Joseph Pawsey, who was Payne-Scott's supervisor and is considered the father of radio astronomy in Australia. He also was one of Payne-Scott's champions and (mostly) stood up for her during controversy.

Considering Payne-Scott's experiences as described in ***Making Waves*** and also Jocelyn Bell's experiences in 1967 when she discovered the first pulsars, it is no surprise that books like this are written. It makes one wonder how many other women in radio astronomy were marginalized so their male supervisors could take credit for their work much like Antony Hewish did to Jocelyn Bell. However, the story of Payne-Scott is different in that nobody took credit for her work and only her employer, the Australian government, committed what we call today

“gender discrimination”, but it did so legally. She was the victim of circumstances that existed in Australia at the time. There lies the sociological aspect of the book, which are well covered.

It is interesting that the sub-title of the book from which *Making Waves* was derived (see above) claims that Payne-Scott was the first woman radio astronomer but the sub-title of *Making Waves* only claims she was a pioneer. Even so, *Making Waves* has a chapter called “1944-1945: Ruby Payne-Scott – The First Woman Radio Astronomer”. It is quite common that claims made as to who was the first to do anything become controversial. In this case, a colleague who is the section director of ASV-RAS, Clint Jeffrey, sent me a 22 page article titled *Dr. Elizabeth Alexander: First Female Radio Astronomer*, about a New Zealand woman who studied radar interference caused by solar radio bursts in WWII. The article actually is an excerpt taken from another very expensive (269 USD) Springer book published in 2005 called *The New Astronomy: Opening the Electromagnetic Window and Expanding Our View of Planet Earth*.

Radar operators in WWII had reported many instances of interference that were not traceable to deliberate jamming by the enemy, but it was noticed that the interference often occurred when the Sun was in the radar beam. This was especially true at frequencies less than a few hundred megahertz used in early radars. Payne-Scott was heavily involved in radar research in Australia as a member of the *Radiophysics Laboratory* (RPL) staff and studied this interference extensively late in the war, and she concluded that the source of interference was solar radio. RPL was a component of the *Council for Scientific and Industrial Research* (CSIR), which later became the *Commonwealth Scientific and Industrial Research Organisation* (CSIRO), all Australian government agencies.

G.C. Southworth reported on solar radio interference to radar in 1942 while he was employed at Bell Labs doing wartime radar research in the USA. J.S. Hey in Britain also became aware of radar interference by solar radio in his own country but he did not study it until after WWII (see my review of Hey’s book *The Evolution of Radio Astronomy* in the October-November 2010 issue of the SARA journal). There undoubtedly were others during WWII who determined the Sun was the source of radar interference but published nothing because of wartime exigency and secrecy and did not follow up at war’s end. This means that we can argue over who was the first to discover and study solar radio emissions and become the third radio astronomer after Karl Jansky and Grote Reber. We also can argue over who was the first female radio astronomer – Elizabeth Alexander or Ruby Payne-Scott. Maybe there were others. However, as Clint pointed out, “*At the end of the day who cares who was first, in this case two amazing women for their time both with scientifically enquiring minds were pioneers in their own right and contributed greatly to the field of Radio Astronomy.*”

After the war, Payne-Scott made important contributions toward the development of interferometers and in early 1946 was the first to use an interferometer in radio astronomy. It consisted of Yagi antenna arrays operating at 200 MHz and allowed her to locate the solar regions responsible for the radio emissions. This work allowed Payne-Scott to associate solar radio bursts with sunspots. She was largely responsible for the initial identification and categorization of Type I and Type III radio bursts. She also developed other types of radio astronomy techniques, equipment and antenna systems that were later used by many other radio astronomers. Like all radio astronomy pioneers and all radio astronomers who made important discoveries, Payne-Scott and her coworkers had absolutely no training in astronomy.

Payne-Scott had obvious technical know-how, produced high quality research and undoubtedly helped put Australia on the map of what would soon become the global endeavor of radio astronomy. According to the

author of ***Making Waves***, she was nobody's fool, outspoken, opinionated and argued aggressively. Many other terms and phrases are used in the book to describe her personality. She was a communist, which was an unpopular ideology or political view in Australia at the time, and was known as "Red Ruby" but not to her face. However, it was not her belief in communism that put her on a collision course with the Australian government bureaucracy. You see, Payne-Scott was married to Bill Hall. Australian law at the time prohibited married women from permanent employment and obtaining any type of pension – only "temporary" employment was allowed for married women. Even though her coworkers knew she was married, the CSIRO bureaucrats did not know and she did not tell them.

Payne-Scott's marriage in 1944 was kept secret until 1950, when she was officially found out by the bureaucracy. She fought the lawful discrimination head-on but then retired in 1951 while pregnant with her first child. In keeping with the law, she lost her entire pension except for her own contributions and received nothing for her years of service and contributions to wartime radar research and, later, radio astronomy. The government kept the interest on her contributions. It is interesting that her salary was not discriminatory (Australian law starting in 1944 required pay equality). It also is interesting that, when Payne-Scott retired, she did not return four small hand tools worth a few dollars that had been issued to her some 10 years before. At first this caused some hand-wringing but, in an ironic episode of bureaucratic anxiety, the tools were eventually written off and she suffered no additional repercussions.

There are many aspects of Payne-Scott's personal and professional life covered in ***Making Waves***. The book also provides many descriptions and citations of Payne-Scott's and her coworker's technical work. These would be well worth studying by anyone interested in early techniques. It is unfortunate that the publisher, Springer, does not know how to market and sell affordable books. Unless you are specifically interested in early post-WWII radio astronomy in Australia and Payne-Scott's contribution to it and happen to have 40 bucks sitting around with nothing to do, ***Making Waves*** is too pricey. Otherwise, it is a very interesting book.



**Reviewer** - Whitham Reeve presently is a contributing editor for the SARA journal, *Radio Astronomy*. He worked as an engineer and engineering firm owner/operator in the airline and telecommunications industries for more than 40 years and has lived in Anchorage, Alaska his entire life.