

## So Few Pulsars, So Few Females

**P**ulsars are phenomenal objects: rapidly rotating neutron stars that send out beams of radio waves which, like lighthouse beams, sweep around the sky as the star rotates. They are amazingly precise timing devices that can be used as clocks for testing relativity theory and may be used for timekeeping and navigation. With a diameter of only about 15 kilometers and a density comparable to that of the nucleus of an atom, they also provide a laboratory for some extreme physics. Although neutron stars were predicted in 1933, they were not recognized until pulsars were discovered in 1967. Since then, there has been tremendous growth in pulsar discoveries, and their importance has been appreciated through the awarding of two Nobel Prizes in Physics: one in 1974 related to the discovery of the first pulsar and one in 1993 related to the discovery of the first pulsar in a binary system.

In the fall of 1967, I was conducting a routine mapping project studying the radio scintillation of quasars for my doctoral thesis at Cambridge University, under the direction of my adviser, Antony Hewish. Investigation of a puzzling weak signal showed it to be a string of pulses, 1.33 seconds apart. We spent a month trying to find out what was wrong, so unexpected was the signal; and we nicknamed it “Little Green Men” (LGM). At the end of that month, I found a second pulsar, killing the LGM hypothesis and indicating a new kind of astronomical source. Being a research student, I had time to understand the instrument, recognize real and spurious signals, and investigate the anomalous or unexpected. Arguably, my student status and perhaps my gender were also my downfall with respect to the Nobel Prize, which was awarded to Professor Antony Hewish and Professor Martin Ryle. At that time, science was still perceived as being carried out by distinguished men leading teams of unrecognized minions who did their bidding and did not themselves contribute other than as instructed! Although I was not included, I celebrated that first award in 1974 of the Physics Prize for an astronomical discovery. Now I celebrate the fact that we have a better understanding of the teamwork necessary for scientific progress.

It took a relatively long time to recognize the first pulsar. However, once that happened, pulsar research rapidly advanced, although often in unexpected ways and in sudden spurts. Following the developments in pulsar research over the past 36 years has given me immense pleasure. More disappointing have been the developments in the recognition and advancement of women in astronomy. In December 2003, the International Astronomical Union (IAU) published an analysis of its membership. With only 10% of their membership female, the United Kingdom and the United States fall well below the international average. The only thing that has changed since a similar survey about 5 years ago is that the proportion in most countries has gone up a few percent. Admittedly, it tends to be the more senior astronomers who are IAU members, and there tend to be more women in the junior ranks, but at this rate it will take 50 years until 50% of senior astronomers are female. The pipeline is leaky: A higher proportion of females than males quit at each rung of the ladder.

I no longer believe that making women more courageous, more assertive, “more like men,” is the right way to move forward. Women should not have to do all of the adapting. It is time for society to move toward women, not women toward society. There have been some excellent female astronomers in the past who were not fully recognized for their contributions. Although advancement and recognition of female astronomers may come in unexpected ways and in spurts, like pulsar research, I hope that they will come more rapidly in the future. However, there are more women in astronomy now than in 1967, when I was a graduate student, and society has grown more accustomed to their intellectual presence. Women have begun to move society toward them, and familiarity will help to breed acceptance. I hope that younger women will find the field increasingly open and accepting, and that their achievements will be readily recognized.

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