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The History of Radio Astronomy: celebrating 90 years of innovation and discovery.

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It was 90 years ago when Karl Jansky announced his discovery of radio noise from the Milky Way Galaxy at the April 1933 meeting of URSI in Washington. Advances radio technology had opened a new window on the universe that revealed an incredibly rich plethora of previously unknown phenomena. Radio Astronomy was born.

Instead of just presenting a historical review of all the discoveries I will explore some of the circumstances leading up to the discoveries, including many stories not generally known, but which provide the background and context. These details are often excised from the standard scientific narrative but are essential to understand the roles played by serendipity, prediction, and technology. There is "nothing fortuitous" in so-called serendipitous discoveries. As Pasteur famously quoted "*In the field of observation, chance favors only the prepared mind.*"

While many discoveries are serendipitous, they depend on the development of new technology. So, it is the telescopes, the instruments connected to the telescopes, and the data analysis that leads to most new discoveries. The scientific discoveries for which facilities become famous are rarely those predicted from the science goals for which the telescopes were built.

Radio telescopes have followed the pattern of exponential growth generally seen in flourishing areas of science and technology, Moore's Law being one famous example. This exponential growth has required continual advances in technology, and I will structure my talk around the different technologies involved; antenna and antenna array designs, aperture synthesis, low noise microwave receivers, computers, digital signal processing, and more recently focal plane and dense aperture plane arrays. Building new generation radio telescope, such as the SKA global science mega-project, will set new challenges.

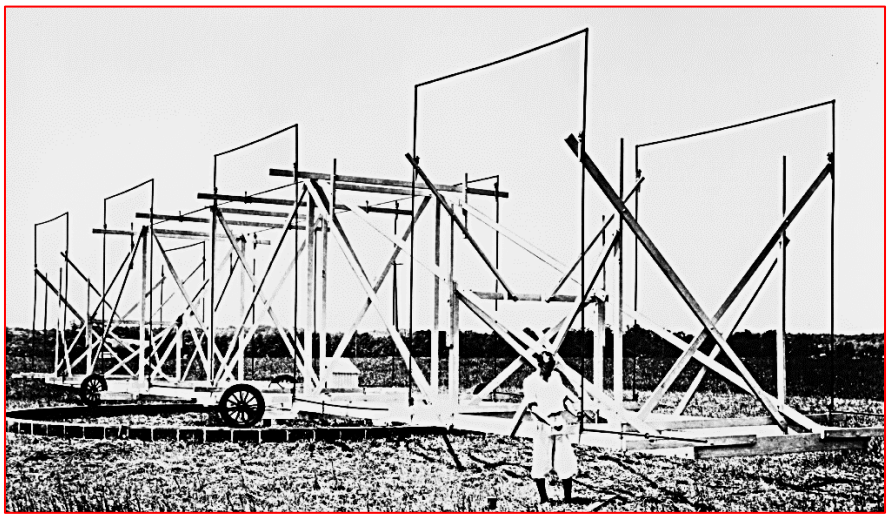

Figure 1. Karl Jansky, working at Bell Telephone Laboratories in Holmdel, NJ in 1932, built this antenna to receive radio waves at a frequency of 20.5 MHz to study the effect of "atmospherics" on communications. It was mounted on a turntable that allowed it to rotate in any direction, and Jansky discovered radiation coming from the center of the Milky Way using this antenna.