

GUGLIELMO MARCONI AND RADIOASTRONOMY

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The decision to hold this IAU Symposium at Bologna on the occasion of the 100th anniversary of the discovery of the wireless telegraphy represents in itself a recognition of the widespread feeling of a historical link between the great discovery of Guglielmo Marconi and the birth of radioastronomy. Obviously, it is not a direct link. We all well know that the birth of radioastronomy must be traced back to the year 1932 when Karl Jansky recognized for the first time the existence of a radio signal probably associated with a celestial source. This a classical example of a 'serendipitous' discovery made while Jansky was investigating for the Bell Telephone Laboratories the sources of radio interferences with a rotating antenna array operating at about 14 m wavelength. The study of local disturbances was of primary importance in the rapid development of radio communications which had been geared by the Marconi's discovery.

Marconi was born in Bologna on April 25th, 1874. Almost precisely 100 years ago with respect to the time of this Symposium (September 1895) he sent a radio signal from Villa Griffone (Fig.1) which was successfully received over a distance of about 1600 m on the far side of an interposed hill, the "Celestini's hill". It is said that the successful result of the experiment was signaled to him by a gun shot fired by a farmer who stood on the side of the receiving apparatus with Guglielmo's brother. Villa Griffone, located on a hill site at about 10 Km south-west of Bologna, was the country mansion of the Marconi's family. It is now the seat of the "Guglielmo Marconi Foundation" which was created in 1938 with the aim of promoting research in radio communications and of perpetuating the memory and work of Marconi. On the back wall of the Villa there is a memorial tablet precisely placed under the window from where Marconi supposedly sent the signal by switching on his spark emitter connected with a parabolic antenna. This is one of the windows of the 'silk worm' room in the Villa



Figure 1. (1) Institute of Physics ‘A. Righi’; (2) Villa Grifone; (3) Radioastronomy Station; (4) Radioastronomy Institute CNR.

attic where the father, Giuseppe, had confined the young Guglielmo while he was doing those strange and, he might have thought, perhaps useless experiments. At that time Guglielmo was only 20 years old! On the other hand the mother, Annie Jameson, immediately captured the potential of the discovery made by the son and sent him to relatives in London where, she thought, it would have been easier to find the financial support required for the practical developments of the invention. The “Wireless Telegraph Trading Signal Co.Ltd.”, which later acquired the name of “Marconi’s Wireless Telegraph Co.”, was founded in 1897 with a capital of 100.000 pounds. It owned worldwide rights on Marconi’s patents with the exception of Italy.

In 1901 a signal sent from the Marconi’s station in Poldhu (Cornwall) was successfully received at St.John’s (Newfoundland). In the following year Marconi crossed the Atlantic on board the “Carlo Alberto” ship leaving Plymouth for Sydney (New Scotland). Strong signals launched from Poldhu were continuously received until the ship finally cast anchor in the bay of Sydney (October 31st) at a distance of 4000 Km, thus definitely establishing the possibility of a transcontinental radio link. A 2500-fold increase in the distance covered by wireless communications in only six years! This gives an idea of the rapidity with which Marconi was progressing in the revolution of the world communication system and, with it, of all socio-economical and political aspects on planet Earth. In 1909 he was awarded the Nobel Prize in Physics. In 1918, toward the end of World War I, he succeeded in sending wireless telegraphy messages from England to Australia.

This was followed twelve years later by a spectacular experiment in which he switched on the lights of Sydney's Town Hall by means of pulses sent from the yacht "Elettra", his navigating laboratory, at anchor in the harbor of Genoa. It is interesting to note that in 1935, the same year in which Jansky conclusively demonstrated the radio emission from the Galaxy, Marconi performed several sighting experiments by means of radio waves on the old Roman road 'Aurelia' in the presence of chief Governmental Authorities, thus anticipating, albeit on a minor scale, the application of radar techniques. The same year he became professor of Electromagnetic Waves at the University of Rome, where he prematurely died on July 20, 1937.

It would take much more time than that available to this opening speech to dwell on Marconi's gigantic personality, his frantic activity, achievements and battles to defend himself against powerful economical interests set in motion by his invention. What I want to do, instead, is to present some less known aspects which see the young Guglielmo regularly attending the lectures delivered by Augusto Righi, a famed physicist and director of the Institute of Physics of Bologna University. At that time Professor Righi was conducting a series of experiments aimed at proving that the properties of the hertzian waves strictly conformed to Maxwell theory. According to a testimony reported in a recent study (Dragoni, 1995) "...It was from the experiments carried out by Righi that Marconi started out on his brilliant discovery. Let us mention, among the experiments concerning the transmission at a distance, that made by Righi in 1889 in Marconi's presence over a distance of 20 m, that is from one end to the other of a corridor facing a lecture hall at the Faculty of Arts...". At that time Marconi was only 15 years old! The above mentioned study reports quotations from Degna, the daughter of Marconi's first marriage, in her father's biography "...Guglielmo, lacking of regular learning, could not enroll at the University of Bologna. He had to adapt to follow Righi's lectures as a simple hearer. Professor Righi did not encourage Marconi very much. However, he enabled him to work in his laboratory..." and from a recently found letter of Guglielmo to his brother written in 1892 "...I am studying very hard to get a Technical High School degree as Professor Righi wishes...". All this, and other testimonies not quoted here, clearly indicate the deep influence that must have been exerted by Righi on the young Guglielmo.

On the other hand the nature of this relationship between the famous scientists and the young inventor was openly stated in a meeting held at the Archiginnasio, the old seat of the University of Bologna, on September 21st, 1902, less than one year after the first transatlantic transmission. Marconi is quoted to have said "It gives me particular pleasure to see Professor Righi present here. He has undertaken major studies on electromagnetic waves and the results of his profound researches have been very useful for

my own discoveries". To which Righi replied "I am grateful for the opportunity to offer him (Marconi) my sincere congratulations. Probably no one was better placed than I was to appreciate, while they were developing, his exceptional creative flair and rare intellectual gifts". On the one hand the physicist who was fighting to produce precise and efficient electrical apparatus working at short wavelengths, which would enable him to conduct experiments on a laboratory size, on the other the young inventor who constructed efficient means of producing and controlling longer wavelengths to connect the world.

Thus one may say that Bologna was at the heart of the scientific and technological events which have dramatically shaped the development of our society at the turn of the last century. It is perhaps not a chance that this 'love affair' with radio waves was reaffirmed in 1959 when it was decided that the Institute of Physics 'A. Righi' of the University of Bologna would have embarked on a major project in radioastronomy. Six years later the "Northern Cross" radiotelescope was opened at a location close to the little town of Medicina, about 26 Km from Bologna toward east. In the year 1970 the Italian National Research Council (CNR) established the Institute of Radioastronomy which took over from the University the running of the "Northern Cross" and became the leading Italian institution in this field of research. It was hosted in the building of the Institute of Physics 'A. Righi' and moved two years ago in the newly constructed premises of the CNR in Bologna where this Symposium is now being held. It can be noted that Marconi himself was President of the CNR, taking over this prestigious office in the course of a solemn ceremony held on the Capitol Hill on February 2nd, 1928.

Similarly to what happened in the world of communications, the development of radioastronomical techniques has brought about a revolution in our understanding of the universe. There is practically no field of astronomy that has not been affected by the analysis of the information carried by the the radio waves, from the study of the planets to the discovery of the cosmic microwave background radiation, a milestone in the cosmological inquiry. And, of course, there is still the hope that soon or later one might be able to identify radio signals which will tell us about the existence of intelligent life established somewhere else in the Galaxy, thus widening the scope and profound implications of Marconi's invention.

References

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