An Investigation of Monochromatic Radio Emission of Deuteronium from the Galaxy

The possibility of monochromatic radio emission of galactic deuterium has been well known for some time, and the frequency of such an emission predicted by Sakodo1. The expected maximum only is such that any attempt to detect the line would rely on extremely long integrations in time. In this experiment, we either direct electrical input over a long period of time and the emission of individual records. One attempt to detect the line using normal methods has already been published6.

The monochromatic used in our experiments was of a design used by van de Hulst, Muller and Oort7. One key feature was the use of a reactance tube rather than two oscillators. A filter band of 15 kHz was used, and the spacing between filters was 48 kHz. These parameters were determined from considerations based on the hydrogen profile on the direction of the galactic centre. The receiver input stage was a simple crystal oscillator, which was used mainly for obtaining uniformity and maximum reliability. The single band oscillator of the receiver was measured as 6., and no noise factor was checked for uniformity over frequency range. A commercial co-axial discharge for checking the noise factor, and this measurement was then checked against laboratory counters. Frequency calibrations of the second band oscillator (1 MHz) was checked by an interference from a 5 MHz, crystal oscillator. These crystal units were in turn checked against WWV. The drift of this oscillator was found to be less than 1 kHz, over a period of a month; consequently, no check was kept on it during an observation, and calibration was limited to immediately before and after a second. The first band oscillator was set on 296 MHz, and a constant check was kept on the heterodyne beat note during an observation with the harmonic of 2 MHz, crystal oscillator.

The antenna system was a paraboloid of 80 ft. diameter, described by McEnery, 13, and Stencel. To maintain the frequency response as flat as possible, a cylindrical dipole was used as the primary feed. As overall calibration of the antenna system was difficult due to the limited angular movement of the beam. However, measurements of radio radiation, which were possible only near the summer solstice, were in good agreement with those made on the same day with other radar equipment. A relative check was set up at the same time, consisting of a known signal reduced from a dipole placed near the antenna. Observations were limited to the region about the galactic center and the region in the galactic plane at 120°. All observations were reduced to the local standard of rest.

Early observations were made in automatically scanned with the receiver through 30 kHz, as the direction of the galaxy passed through the antenna. Such methods failed to detect any radiation. In the later records, graphical integration was performed to increase the sensitivity. A complete frequency scan occupied 15 min, and to compensate partially for the observation with a fixed antenna, the phase of the frequency with respect to sidereal time was staggered on successive runs. The time constant of the instrument was 1 min. Fig. 1 shows the profile expected from a monochromatic line (and Figs. 1b) and (C) the diagram of the results of observations at declinations −32°5′ and −28°. Fig. 2 shows eight integrations at declination −32°5′, together with a sample integration of noise alone for the same number of records.

There was still some doubt about Fig. 2, further series of four observations with a time-constant of 3-5 min, and a scan of 60 kHz was made at declination −32°5′, and the results are given in Fig. 3.
A Simple Method of studying Winds in the Ionosphere by using Continuous-wave Radio

Neumann's study of land-sun movements in the ionosphere has been made during the past few years by using the spectrophotometric technique developed by Joulin, which is applicable only for the F-region, and the spectrophotometric method first employed by Minnaert. However, both these methods require elaborate and expensive ionospheric probing equipment. We present here a simple method of studying winds in the ionosphere using continuous-wave transmission and a simple receiver with a recording system.

The method is essentially similar in principle to the spectrophotometric technique and involves the use of continuous-wave transmitter from a distant short-wave transmitter arriving at the receiving site by way of single reflection from the ionosphere. Simultaneous records of the variations of signal strength at three spaced points due to these transmissions showed aperiodic patterns which are almost identical but displaced in time. The wind velocities and directions are then computed from these time displacements using a method similar to that in the spacial-receiver pair method.

Continuous-wave transmissions from stations on the 21-meter band have been used in this investigation for obtaining the simultaneous records of variation of signal strength as the ionospheric layer moves. Three simple vertical needles, R1, R2, and R3, each of length 4 ft, are placed at the corners of a right-angled triangle each 15 ft, R1 and R2, and R2 and R3, are along the north-south and east-west directions and separations of 84 and 60 meters respectively. The signals reflected from these needles are brought to a central recording station by using coaxial shielded cables. In the earlier part of this investigation we used three gap antennas which are usually shaped, and three communication channels centered on these needles, for obtaining the simultaneous records of the variations of signal strength. Each signal reflected from these three gap antennas were put on the variations of signal strength scale by scale on the same photographic paper moving with a speed of 17 cm per minute. The photographic paper is marked on a special drum (21,000 rpm) driven by a synchronous motor at the rate of one revolution per minute. With the view of eliminating the variation of any of the signal-strength records for all the scales, we afterwards simplified the technique still further by using only one communication receiver, N. V. receiver H R 1, and a specially designed two-pole three-way rotary switch driven at 1,400 rpm by a 1/10 hp motor. The switch consists of two sections each of which has a rotating winding over three isolated, brass contacts of small length arranged in a ring. The input and output winding on the contacts of the receiver are connected to the aerial wires of two sections of the switch in such a way that during the passage each gap antenna is connected to the amplifier signal from one of the arcs only during one-third of the time. The ratio of variation of the complete wave of the both hands of the switch is highly, a smooth studding signal is obtained, though it in an interrupted signal that is 6 to 11 gap antennas.

Fig 1

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Table 1

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