A LOW FREQUENCY ARRAY DESIGNED TO SEARCH FOR THE 327 MHZ LINE OF DEUTERIUM

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An array has been constructed to search for the 327 MHz line of deuterium. The array, which is located near the Haystack Observatory, Westford, Massachusetts, consists of 24 stations covering about 1 hectare. Each station is an array of 24 active crossed Yagi antennas mounted on a 4.4 x 4.4 m ground plane. A 48 channel receiver, consisting of analog downconversion followed by A/D conversion, digital downconversion and filtering is mounted below the ground plane of each station. Multiple station beams are formed in software and the spectra from the stations are periodically transfered via fiber optic ethernet to a central processor. The array design is optimized for the expected diffuse nature of the deuterium line emission so that the signals at each station are uncorrelated and the multiple stations provide a means of acquiring the same amount of station data in one year that would take 24 years with a single station. Special care has been taken to limit the self-generated RFI by enclosing the receivers in well shielded boxes and double filtering the A.C. power lines entering each receiver. The effects of external RFI have been minimized by adding resonant directors which make Yagi elements that have 10 dB less gain near the horizon than dipole elements. In addition the software at the central processor performs excision of RFI transients and suppression of discrete RFI carriers.

The array characteristics are:

Number of dual polarization elements per station	24
Number of stations	24
Receiver noise temperature	40 K
Station beamwidth	14 degrees
Number of simultaneous beams processed	4
Receiver bandwidth	250 kHz
Receiver resolution	244 Hz

The estimate of the D/H abundance in the interstellar medium of about 15 ppm from the Lyman-α observations of the FUSE satellite results in an expected opacity of the 327 MHz line of only about 8 ppm. The expected signal strength, accounting for receiver noise, beam efficiency and scan loss is about 4 ppm in a 10 kHz bandwidth. This should result in a 6 sigma detection in 1 year observing the anti-center with the 24 station array for 4 hours per day.