NLSRT Memo No. 11

From: CVAX::AWOOTTEN "Al Wootten" 29-NOV-1988 16:33
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Memo to: Paul VandenBout, Barry Turner, H. Liszt, J. Lockman, K. Kellerman
& others
From : Al Wootten
Subject:NX$UY6escope for GreenBank?

A. Only a big dish can rmamly replace the 91m.

A recent memo from Barry listed some priorities for spectral regions and conclusions based on them supporting continued support for the 43m in Green Bank. I pretty much agree with his conclusions, i. e. that the scientific grist which kept the 91m going suggests a new telescope should also have a very large aperture available at low frequencies. At moderate frequencies, 5 to 25 GHz, the 43m works admirably well--it must be responsible for the lion's share of published data at frequencies of 2cm to 1cm, and hardly needs replacing.

B. The 25-52 GHz band IS scientifically quite interesting.

Because of the inclusion of this band in the paradigm MMA design, and because of the VLD discussion last spring, I have thought a bit about its uses. In the 25 to 52 GHz band, I think the scientific case is somewhat stronger than just the observation of SiO masers in late-type stars. Molecules heavier than 30-40 amus such as HC3N are excellent probes of the structure of dense cool clouds. At temperatures of 10-20K and densities below 5x10(4) or so, the strongest transitions of HC3N are the 3-2, 4-3 and 5-4 lines at 27, 36, and 45 GHz. The higher lines, at 72 GHz and above, are quite weak as typical clouds lack the density to excite them. The densities of these clouds would be well-constrained by observations of these lines. The fundamental C3H2 1(1,1)-0(0,0) line lies at 51.8 GHz, and several other diagnostically useful lines also lie in the band (2(1,1)-2(0,2) at 46.7 GHz and the 3(21)-3(12) line at 44.1 GHz, for two examples). The fundamental CS J=1-0 line at 49 GHz is also useful. In the US, this band is at present addressed by the Haystack telescope and FCRAO. I believe the 43m could operate very usefully in at least the lower part of the band, and hope that it soon will.

The low end of the band can be sensitively observed with the maser receiver at Onsala, and the high end may be observed at Bonn or Nobeyama. The combination of the Nobeyama array with the 45m is a particularly potent tool for observations in this range, but in practice the NRO instruments and the Onsala intrument are usually employed at higher frequencies except during poor weather in the summer months. I believe the common perception of this band as a scientific wasteland is due to its relative inaccessibility and consequent lack of exploitation. It's a little like the 2mm band at higher frequencies in this respect. I would rank its potential alongside the 1.8 to 5 GHz band (I would rank 7) and above anything between 5 and 12 GHz (apologies to Rood and Bania but this band defines absolute 10 on my scale). I rank 25-52 Rank=5.

C. Since scientific priorities are strongest at lowest and highest frequencies, and the antenna deficiency is at lowest frequencies, we need a very large low frequency telescope. The 43m should be maintained and upgraded.

ne VLD 70m design is a good upgrade for the 43m,
ut targets scientific problems which are currently adequately addressed by the 43m, Haystack, FCRAO and potentially the MMA in the US and several facilitie
s
abroad. I believe the 43m should be maintained and its upper frequency envelope expanded to at least 36 GHz. I think access to higher frequencies will draw in more users interested in star formation and the structure of dense clouds, considerably increasing the pressure on the instrument. I have no doubt that the user interest in the 70m described in Ken's report would be lively with most pressure at the higher frequencies, but little time would be available for pulsar or 21cm work on this smaller (than the 91m) instrument.