12 GHz methanol receivers for the AT

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A methanol line at 12.178 GHz has recently ben discovered by Batrla et al. (Nature **326**, 49. - see also Nature **326**, 12, and Ap.J. **321**, L159.) in several regions of star formation. The strength of this line (up to 1300 Jy) makes it considerably stronger than corresponding OH masers, with which it appears physically associated. The astrophysical importance of this cannot be overstated: this line promises to yield the same sort of detailed information as have the OH masers to date, and yet it probably samples a different physical regime from the OH masers, offering a chance to add pieces to some very sparsely filled jigsaws in the study of star formation. I have no doubt that, if this line had been discovered a year or two earlier, 12.178 GHz would be a standard AT frequency.

The designs for the AT receivers and feeds are now too far advanced for any fundamental changes to be made at this stage. Nevertheless, we are in a better position than, say, the VLA in that we do have some flexibility still, and we could be in a prime position to execute some far-reaching work if we could find a way to get some 12 GHz capability on the AT. **The main point I want to make is that we should try very hard to find a way of equipping the AT for 12 GHz.**

The 20/13/6/3 cm receivers to be installed first on the AT will probably give us little opportunity for doing really new science in the early days of the AT, except insofar as we can observe regions of the sky inaccessible to northern observatories. In contrast, it is unlikely that anyone else, in the north or south, will be producing synthesis maps of the methanol masers in the immediate future. Therefore, if we could install 12 GHz recievers on the AT we would be in the position of producing the first maps of the methanol masers, resulting in dramatic first-class science from the earliest days of AT operation.

The second point I want to make is to suggest two ways in which this might be achieved with the expenditure of very little extra manpower. Commercial room-temperature FET receivers are available for a few hundred dollars. The high brightness of the methanol masers means that such receivers are entirely adequate, as demonstrated by our recent successful observations (Ap.J. **321**, L159.) at Parkes using a lash-up system centred on one of these receivers. Furthermore, a 12 GHz feed has already been produced for the Culgoora antennas for antenna testing purposes, so that feed production involves no more than the duplication of an existing feed.

(1) The first way in which a 12 GHz capability could be implemented is an interim one. The 3.5/2.6 mm AT receivers are unlikely to be installed for some while, and so a commercial 12 GHz receiver could be installed in the slot reserved for the 3.5/2.6 mm receiver. These 12 GHz receivers include a LNA, LO (which must be bypassed for our purposes), mixer, IF amplifier, etc. We have, within the

Division, already acquired experience in modifying these units. and so the only additional manpower required would be to derive an LO from the present LO system, and connect the IF from the amplifier into the AT back end. A suitable way to do this might be to derive a 13.6 GHz LO by doubling the 6.8 GHz signal from the existing 7 GHz synthesiser, and feed the resulting 1.42 GHz IF signal into the 1st IF as is done for the 3/6 cm receivers. Thus this system could be implemented with very little additional manpower required from AT staff.

(2) The second way to implement a 12 GHz capability is a long-term one. At present, the AT specification (C.1.3) calls for all the Culgoora antennas to be equipped with an offset 3-cm feed, although I gather that in fact only one antenna will be so equipped. I would suggest that in fact all antennas (other than the one equipped for 3 cm) might be equipped with dichroic plates and that the offset 3-cm receiver position could be occupied by a commercial 12 GHz receiver and feed. This development need not occur until the 3.5/2.6 mm receivers are installed.

Note: Option (2) would require a different dichroic plate design from the 3 cm systems.

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