1. Introduction

MALT-45 is an untargeted Galactic plane survey, searching for tracers of high mass star formation (HMSF) at 4 mm. This survey is conducted on the Australia Telescope Compact Array (ATCA). With the recent upgrade to the ATCA correlator, we are able to map the Galactic plane with high sensitivity for 12 spectral lines simultaneously. Additionally, this survey uses the autocorrelation data from the multiple antennae. Compared to the sample [HII] southern Galactic Plane Survey (HOPS) on Mopra, MALT-45 is much more efficient, as we are in the extension of the ATCA in autocorrelation mode effectively as a 6-element multibeam system. This gives excellent sensitivity to extended emission with a beam resolution of about 10".

MALT-45 is the first multi-degree-scale untargeted survey of Class I methanol masers at 4 mm. This is achieved by a comparison to maser emission from other surveys, such as stellar masers from HHOPS, Class II methanol masers from the Methanol Multibeam project (excluding those associated with HMMF), and OH masers from SPHERIS. In doing so, we will be able to better understand the evolution of HMSF through time.

Simultaneously, MALT-45 maps bright CS (1-0) emission, as well as other thermal lines associated with HMSF. The CS data collected is useful in probing optically thick clumps, as C34S emission can be used to measure the optical depth in these regions.

SO (1-0) lines have rarely been detected towards regions of HMSF, but are generally associated with evolved stars. MALT-45 will also observe multiple SO (1-0) lines to reveal more SO masers in an untargeted way.

2. Survey Parameters

Survey technique:
- On-the-fly mapping
- Orthogonal mosaicking (Heap-point sampling)
- 64 seconds per pointing
- Collects both interferometric and single-dish data simultaneously

- Each spectral line is mapped with a CASA-like 34 MHz channel width
- Full spectral line is mapped with a CASA-like 34 MHz channel width
- The spectral line is mapped with a channel resolution of 2 kHz
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- The two 2 GHz continuum spectra are also collected, and will allow us to discriminate between dust continuum emission and free-free emission
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- This also allows us to identify new HHII or UCHII regions

3. Results

Extended CS (1-0) emission is detected throughout the survey region. This emission is generally found towards young dust traced by evolved IR sources (e.g. GLIMPSE), cold regions such as HIOs, but also CS is found in regions where there is no IR counterpart. Many clumps are identified through CS that do not show HOPS NH3 (1,1) emission.

3.1. SO (1-0)

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3.2. SiO (1-0)

MALT-45 has detected all new Class 1 methanol masers on top of the 100 previously known within the survey region. Two of the previously known masers are very bright and have been known for many years, while the other 61 masers are associated with Class II masers or are associated with extended ionized objects (EOOs). The ratio of each of the new Class 1 masers not associated with EOOs or known Class II counterparts is yet to be investigated. With follow-up observations, we hope to gain better insight into their nature and driving mechanisms.

Of the 61 SiO masers detected, 14 have previously been reported. All maser regions appear to be associated with evolved O/IR stars rather than star forming regions. All but two SiO masers contain the v=1 line, while 12 regions lack v=2 emission. The v=2 transition is weak, and a combination of both, or it is only detected towards two regions. Two regions appear to contain only the v=2 transition and are not detected in either the v=1 or v=3 lines.

As the survey was only recently completed (April 2013), the full survey results are in the infancy and data reduction techniques have been improving with time. The full survey results will be published later this year.

Further details on the MALT-45 survey can be found in the pilot paper (Jordan et al., 2013, MNRAS).

4. Figures

Top: MALT-45 CS (1-0) emission overlaid with blue HOPS NH3 (1,1) contours. Middle: GLIMPSE 3-colour (3.6, 4.5, 8.0μm) image with white MALT-45 CS (1-0) contours. Bottom: GLIMPSE 3-colour (3.6, 4.5, 8.0μm) image with locations of methanol (cross symbols) and SO (circles) masers. Green crosses represent previously unknown Class I methanol maser regions, while blue represent previously known regions.