ASKAP observations of known and new Galactic SNRs

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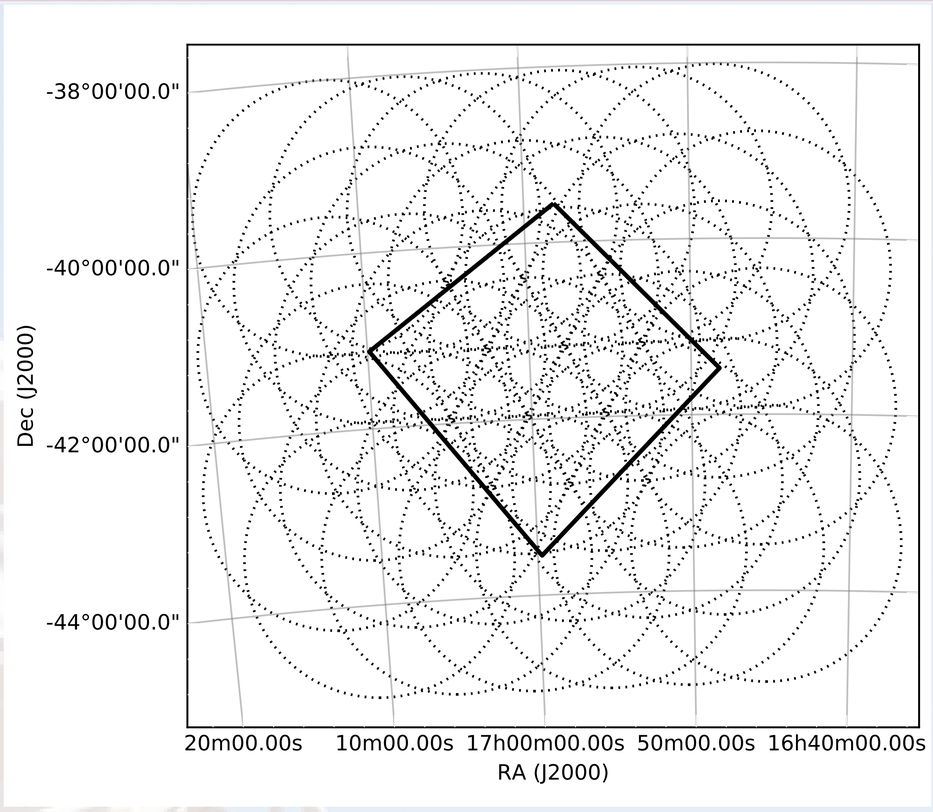
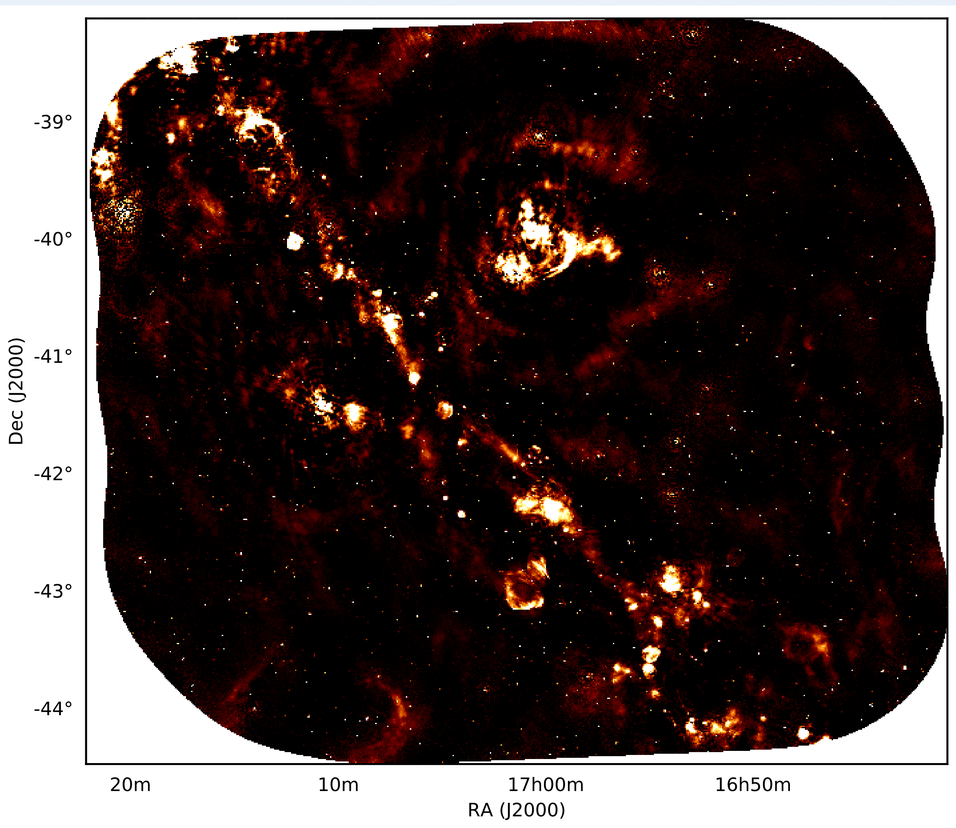
Introduction

The Australian SKA Pathfinder (ASKAP) is one of the three precursors of the future Square Kilometre Array, along with MeerKAT and MWA. ASKAP consists of 36 antennas, all fully operational since March 2019, and it is specifically designed to conduct large deep surveys in very short amounts of time, thanks to the Phased Array Feed technology. One of these large surveys is EMU (Norris et al. 2011), which is an all-sky continuum survey at ∼1 GHz. SCORPIO is a small (∼40 deg^2) pathfinder survey for the Galactic part of EMU, aimed at predicting its scientific return in the Galactic plane and study its technical challenges in data reduction and analysis (Umana et al. 2015). The SCORPIO field was observed with ASKAP in 2018 and 2019 as the only Galactic field of the ASKAP early-science program.

Observations

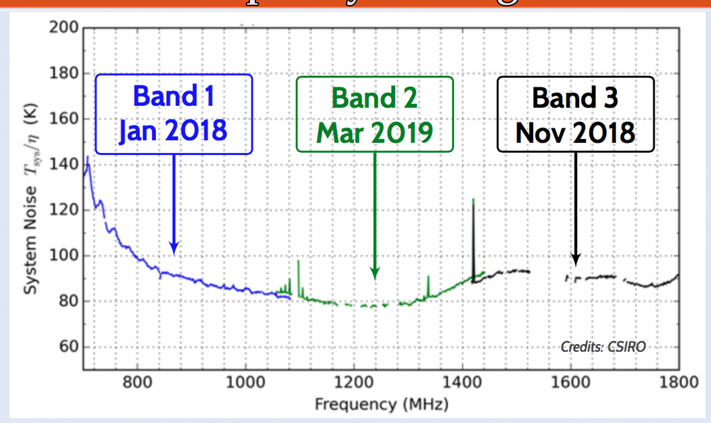


ASKAP is capable to observe in 36 different directions simultaneously, largely expanding its instantaneous field of view. In this plot the single-pointing ASKAP field of view (dotted circles) is compared to the original SCORPIO surveyed area, obtained with 133 pointings of the Australia Telescope Compact Array.



Global view of the ASKAP image of the SCORPIO field at 912 MHz. This image was obtained tuning the ASKAPsoft pipeline to fit the Galactic plane data reduction needs, in terms of accounting for the huge number of extended sources and the Galactic diffuse emission (Umana et al. *in prep.*). More than 3500 sources have been extracted and their characterization is in progress.

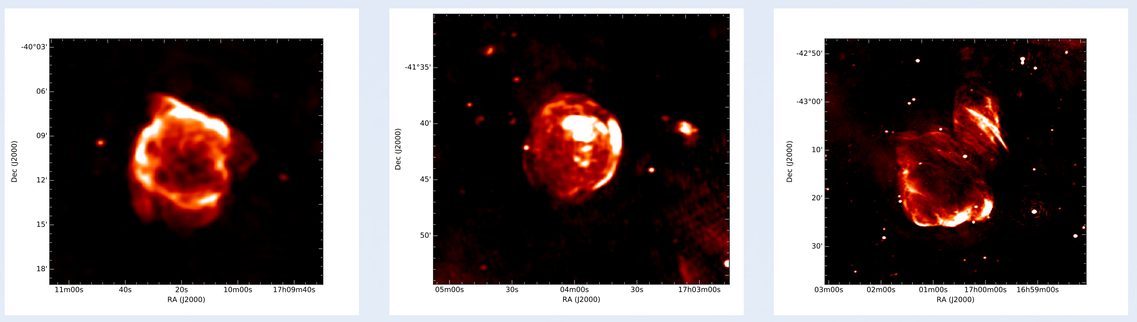
Frequency coverage



The SCORPIO field was observed in all the three bands of ASKAP using respectively 15, 36 and 28 antennas. Band 2 and 3 data reduction is ongoing and spectral information from all the sources will be extracted once images in these bands will be produced.

Observing SNRs

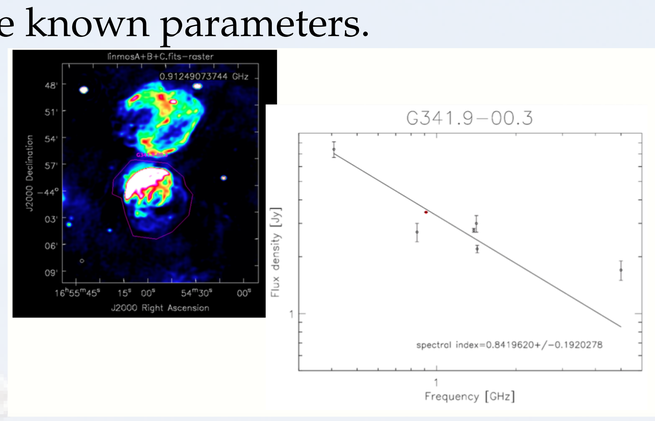
The observed field harbours 17 SNRs known from the literature and all of them are detected. The extremely good *uv* plane coverage results simultaneously in a good resolution (up to 10″) and in a significant capability to properly image extended sources (with a largest angular scale of ∼40 arcmin).



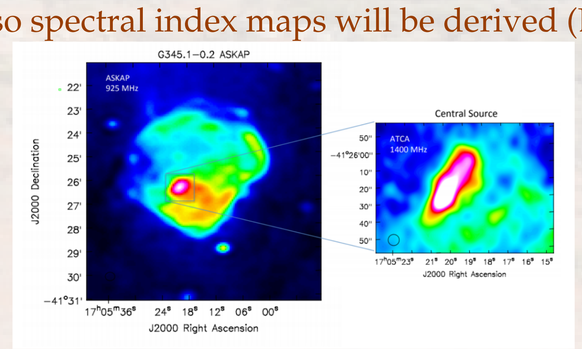
A sample of three known SNRs as imaged by ASKAP. It is possible to appreciate the potentiality of the instrument to image in detail SNRs over a large extension range.

Three of the 23 new possible SNRs in the SCORPIO field. Radio morphology and infrared counterparts are going to play a key role in discovery new SNRs from surveys like EMU (Ingallinera et al. *in prep.*; Bufano et al. *in prep.*).

Studying in detail single objects is another valuable effort both to validate ASKAP early-science data and searching for new features or refine known parameters.



Spectral energy distribution of SNR G341.9-00.3. The ASKAP flux density is the red circle (calibration errors are not considered in this plot). It is possible to appreciate how the flux density measurement is in agreement with the other values available in literature (black dots). Once also band 2 and 3 data will be reduced also spectral index maps will be derived (Loru et al. *in prep.*).



One of the SNR candidates in SCORPIO was recently investigated for the possible presence of a pulsar wind nebula. A *Chandra* proposal (PI S. Mereghetti) was recently submitted to obtain an X-ray image of this object.

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Background image (ASKAP) credits: CSIRO