Observations of Pearson-Readhead Survey Sources using VSOP and the EVN


We present high resolution images, preliminary analysis, and interpretation from VSOP space VLBI observations of Pearson-Readhead survey sources. We will highlight several of the sources that have been observed using a combination of the HALCA spacecraft and the EVN.

\textit{astrophysics}

4\textsuperscript{th} EVN/JIVE Symposium - October 1998
INTRODUCTION

- The VSOP mission uses an Earth-orbiting antenna (HALCA; launched 1997 February) and ground-based facilities (radio telescopes, tracking stations, and correlators) to form a VLBI array with maximum baselines of approximately 30,000 km and $u$-$v$ coverage suitable for imaging.

- Observations at 5 GHz yield maximum resolution of approximately 0.2 mas, a good match to 15 GHz observations on the ground.

- For the 1st VSOP Announcement of Opportunity we proposed observations of sources from the complete Pearson-Readhead (PR) sample.

- The PR sample consists of 65 extragalactic radio sources with:
  - $\delta > 35^\circ$
  - $|b| > 10^\circ$
  - $S_{total}(5GHz) > 1.3$ Jy

- To select our sample of 31 sources from the PR sources we add:
  - $S_{>6000km}(5GHz) > 0.4$ Jy

- To date we have completed observations of 18/31 sources. Each observation consists of data from one HALCA orbit (6 hrs) and an array of ground radio telescopes. For 6 of these observations EVN antennas have been used.
RESULTS

• Sources observed with VSOP/EVN observations include:
  - 1954+513
  - 2021+614
  - MKN501
  - 1642+690
  - 3C345

• We aim to measure accurate brightness temperatures ($B_T$) for the PR sample.
  - $B_T$ sensitivity $\propto D^2$
  - Ground-based observations are only sensitive to $B_T \sim 10^{12}$ K $\equiv$ nominal inverse Compton limit
  - Space VLBI observations are required to detect $B_T > 10^{12}$ K
  - $B_T \propto \delta$

• What is the brightness temperature distribution for a complete sample of radio sources? Is there a characteristic maximum brightness temperature? How does it compare to the nominal $10^{12}$ K inverse Compton limit.
Beam FWHM: 0.507 x 0.229 (mas) at -10.5°

Contours: -2, 4, 8, 16, 32, 64

Map peak: 0.435 Jy/beam

Map center: RA: 16 42 0.7 ± 0.49, Dec: +68 56 39.7 ± 0.0 (2000.0)

Right Ascension (mas)

Relative Declination (mas)

1642+690 at 4.970 GHz 1998 May 31

Clean map. Array: EMNRMW EGMNRMW EGMNRMW EGMNRMW EMNRMW
Beam FWHM: 0.424 x 0.254 (mas) at -40.2°

Contours: 5, 10, 20, 40, 80

Map peak: 0.313 Jy/beam

Map center: RA: 19 55 42.738, Dec: +51 31 48.546 (2000.0)

Right Ascension (mas)

Relative Declination (mas)

1954+513 at 4.970 GHz 1997 Nov 10

Clean map. Array: EGMOR-TWN
Beam FWHM: 1.99 x 0.924 (mas) at -50.10

Contours %: -0.5 0.5 1 2 4 8 16 32 64

Map peak: 1.18 Jy/beam

Map center: RA: 20 22 06.82, Dec: +61 36 58.805 (2000.0)

Relative Declination (mas)

Right Ascension (mas)