Abstract

Co-ordinated VSOP and Chandra Observations of 0836+710

Murphy D.W., JPL

In this paper we describe the radio observations that form part of co-ordinated Chandra, HALCA+VLBA, and VLBA-only observations of the high redshift (z=2.17) superluminal gamma-ray loud quasar 0836+710. The radio observations were at 6 frequencies (1.6, 5, 8, 15, 22, and 43 GHz) with the two lower frequency observations being undertaken with the VLBA co-observing with the HALCA spacecraft (which is the space element of the Japanese VSOP mission). The aim of the radio observations is to determine the peak brightness temperature for each of the VLBI radio components and hence provide better constraints on predicted X-ray emission than has previously been possible from radio data. Combining the radio data with the X-ray data enables the nature of this gamma-ray loud AGN to be further elucidated.

Part of this work has been undertaken at the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.
Coordinated VSOP and Chandra Observations of 0836+710

David W. Murphy, JPL
Source Selection

- PKS 0637-752 showed benefits of coordinated observations
- Compare Chandra and VSOP source lists: 74 `matches'
- 7 EGRET sources: 0235+164, 0836+710, Mrk 421, 1156+295, 3C273, 2155-304, and BL Lac
- Mrk 421, 2155-304 synchrotron not IC X-ray emission
- Good VSOP AO3 observations for: 0836+710, 3C273, 1156+295
- Chandra and VSOP observations:
  3C273: 9-Jan-00, TBD
  1156+295: TBD, TBD
0836+710: VSOP+VLBA Observations

- Target of opportunity proposal
- Observation date: 7-Oct-99

06:00--17:00 (11 hours)
  2 VSOP orbits
  HALCA: 1.6 GHz and 5 GHz, LCP only
  VLBA: switching: 1.6 GHz or 5 GHz, LCP+RCP

17:00-20:00 (3 hours)
  15, 22, and 43 GHz VLBA snapshots
1.6 and 5 GHz HALCA+VLBA UV-coverages

1.6 GHz

5 GHz
1.6 and 5 GHz HALCA+VLBA and VLBA-Only Images

1.6 GHz

VLBA-only images

VLBA+HALCA images

5 GHz
Component Spectra and Brightness Temperatures

- Component definitions
  - Core (C0) is inverted
  - Jet components are steep spectrum

- Only Core (C0) and first jet component (C1) has brightness temperatures above the $10^{12}$ K IC limit
Conclusions

• Started a program to undertake coordinated Chandra and VSOP observations
• HALCA 1.6/5 GHz and VLBA-switching is a very efficient way to undertake SVLBI observations
• Small amount of extra VLBA time provides large increase in science return
• 0836+710: X-ray emission dominated by core and 2-mas component

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