

Low-Frequency JVLA Observation of a Radio Relic in the Merging Galaxy Cluster Abell 2146

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Introduction

Abell 2146 is a merging galaxy cluster exhibiting two shock fronts: a bow shock preceding the subcluster A2146-A and a slower upstream shock trailing the main cluster A2146-B (Russell et al. 2010). Previous deep observations with the GMRT at 325 MHz and the JVLA at 1.4 GHz suggested the potential presence of diffuse radio emission consistent with a relic; however, its existence in the outskirts of the cluster has remained uncertain. This study aims to confirm and characterize the presence of a radio relic in the outskirts of Abell 2146 using recently available 230–470 MHz archival data from the JVLA. The archival JVLA 230–470 MHz data of Abell 2146 were processed using CASA, performing flagging and calibration.

Data

Key Properties of the Galaxy Cluster A2146

Property	Value / Description
Redshift (z)	$z = 0.2323$
Total Mass (M_{vir})	$8.5^{+4.3}_{-4.3} \times 10^{14} M_{\odot}$
Bow Shock Mach Number (\mathcal{M})	$M = 2.2 \pm 0.8$
Upstream Shock Mach Number (\mathcal{M})	$M = 1.7 \pm 0.3$
Subcluster Velocity	$2200^{+1000}_{-900} \text{ km s}^{-1}$
Dynamical State	<i>Active</i>

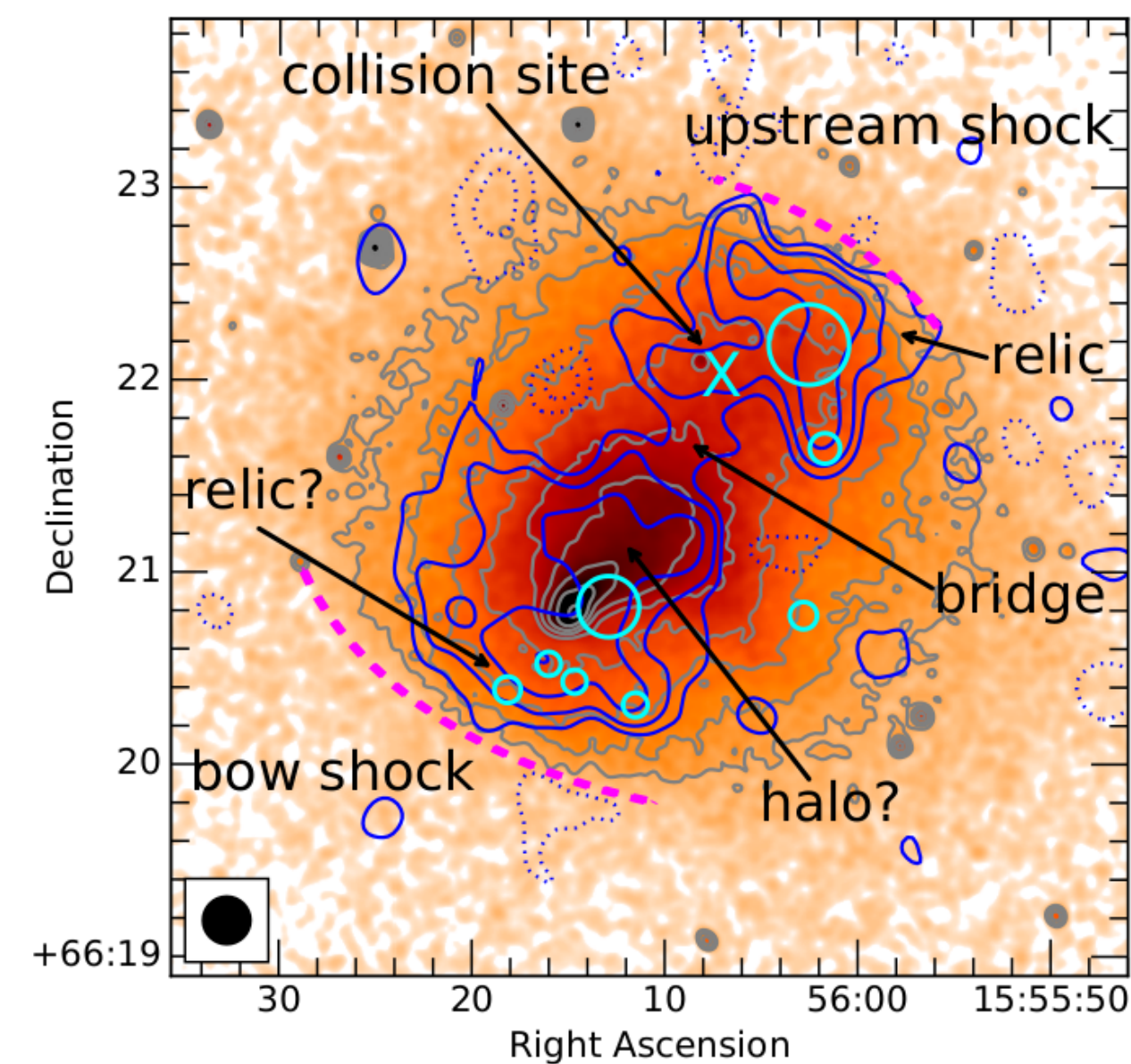
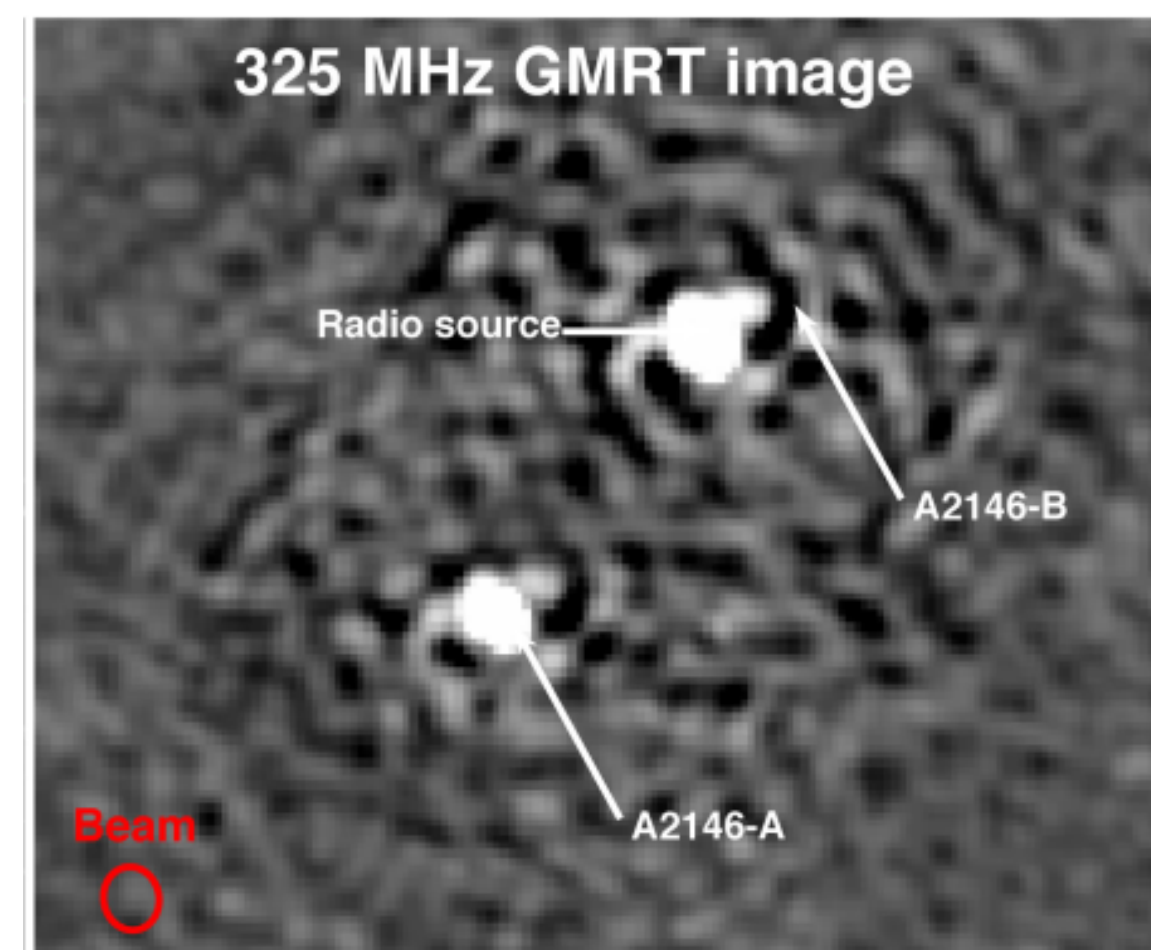


Figure 1: Chandra image.



Methods

The data were processed through standard radio interferometric procedures, including flagging, flux and band-pass calibration, gain calibration, and application of calibration solutions to the target data. These steps ensure accurate flux scaling and correction of instrumental and atmospheric effects.

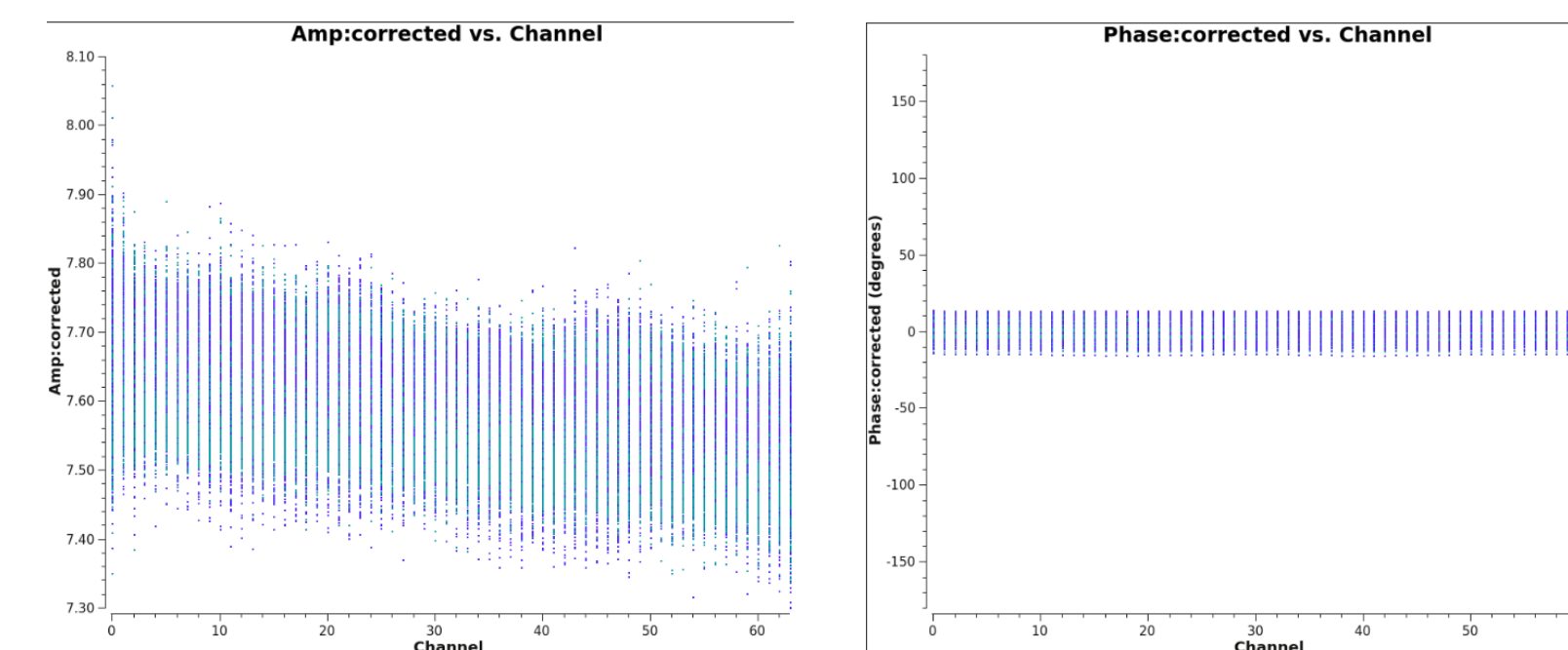


Figure 3: Left: amp:corrected vs channel. Right: phase:corrected vs channel.(3C286).

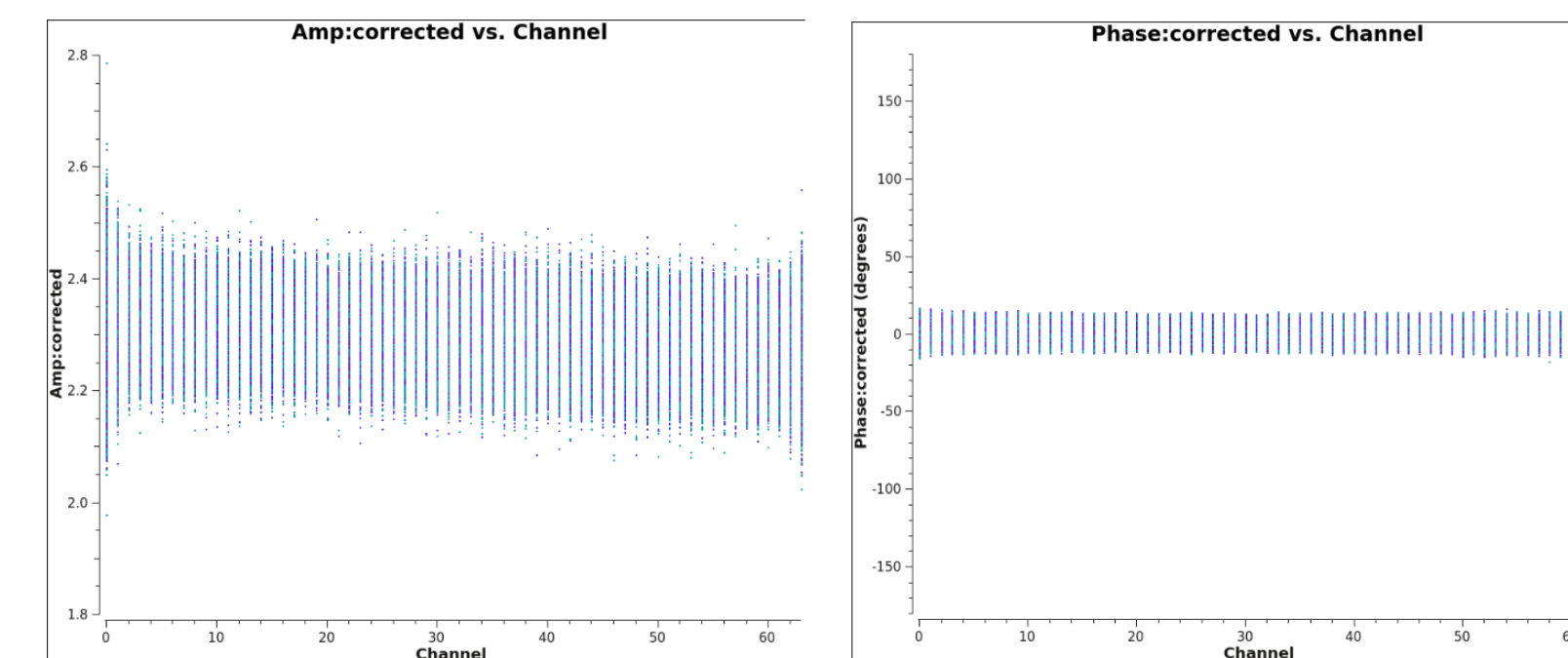


Figure 3: Left: amp:corrected vs channel. Right: phase:corrected vs channel.(J1459+7140).

Ongoing works

- The JVLA 230-470 MHz data of Abell 2146 were preliminarily calibrated and assessed, confirming their suitability for high-sensitivity imaging.
- Ongoing imaging and spectral analysis aim to investigate the cluster's morphology and emission properties.

Conclusions and Recommendations

- This study presents the ongoing analysis of low-frequency JVLA observations of the merging galaxy cluster Abell 2146.
- Initial data reduction and calibration have been successfully completed, providing a reliable foundation for imaging and scientific interpretation.
- Future work will focus on deep imaging, compact source subtraction, and spectral analysis to confirm and characterize a potential radio relic.

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Reference

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H. R. Russell.,2010,MNRAS,406,