

Research Motivation

The 1977 Wow! Signal has remained one of the most intriguing unexplained phenomena in Search for Extraterrestrial Life (SETI) research. Méndez et al. (2024) recently proposed a new astrophysical explanation: the signal was caused by a magnetar flare that triggered sudden hydrogen brightening in interstellar clouds. We hypothesize that if a magnetar flare caused the Wow! Signal, we should find optical evidence of this high-energy event in archival sky surveys.

Our research seeks to answer key questions: (1) Did any stars suddenly brighten near the Wow! Signal location on August 15, 1977? (2) Can we detect magnetar-like optical flares in the Big Ear telescope field? (3) Do our findings support this new astrophysical explanation?

We conducted a systematic search of 45+ years of optical archives for transient sources that match the timing and location of the original radio detection, testing the magnetar trigger hypothesis through optical observations.



Figure 1: The Ohio State University Big Ear radio telescope, which detected the famous Wow! Signal on August 15, 1977.

Background

On August 15, 1977, the Big Ear Telescope of Ohio State University (**Figure 1**) detected a remarkable signal during their Search for Extraterrestrial Life (SETI) program. The signal, reading "6EQUJ5" on the data printout, was 30.5 times stronger than background noise at 1420.456 MHz near the hydrogen line. Astronomer Jerry R. Ehman discovered it the next morning and famously wrote "Wow!" on the printout, giving the signal its enduring name.

Despite nearly five decades of follow-up observations, the Wow! Signal has never been detected again. The Big Ear's dual-horn design recorded data from two beams separated by 3 minutes in right ascension, but the system could not distinguish which horn detected the signal, leaving its precise location uncertain. This ambiguity, combined with the signal's transient nature and proximity to the hydrogen line, has made the Wow! Signal one of the most intriguing unsolved mysteries in SETI research, inspiring numerous explanations ranging from extraterrestrial communications to various astrophysical phenomena.

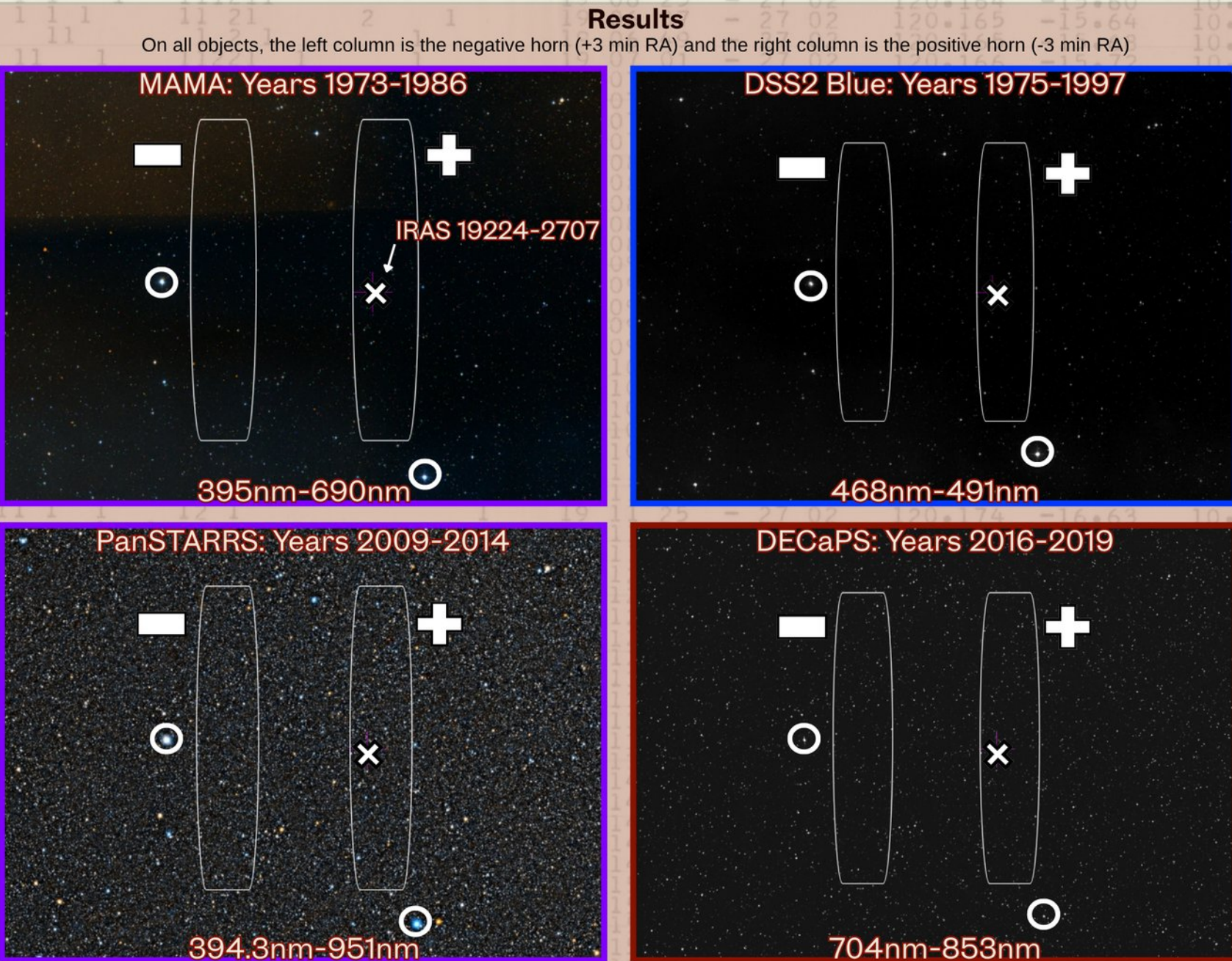
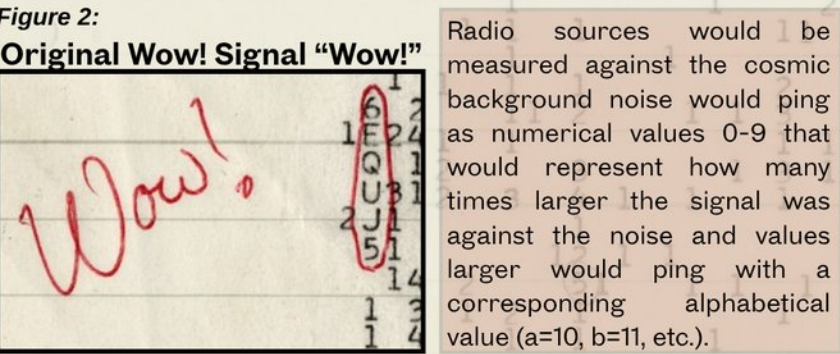


Figure 3: Results from our optical survey images of the Wow! Signal field across four decades. Each panel shows both Big Ear telescope horn regions (outlined) with the negative horn on the left and positive horn on the right. Wavelength ranges and observation years are indicated for each survey. No obvious transient sources or stellar brightenings are visible across the temporal baseline. IRAS 19224-2707 is a potential source from where the original Wow! Signal came from. This is due to its proximity to where the Wow! Signal was from. Analysis of stars around IRAS 19224-2707 have been done and further analysis of stars is being studied.

Conclusion & Next Steps

We systematically examined 44 optical archival surveys covering the southern sky, with 9 surveys containing data for our target region. Four major surveys (MAMA, DSS2 Blue, PanSTARRS, and DECaPS) provided the most comprehensive temporal coverage and are presented in **Figure 3**. Our initial visual inspection revealed no obvious transient sources coincident with the Wow! Signal timing and location.

With thousands of stars present in each horn, we are conducting systematic cross-matching across decades to identify any sources that have appeared, disappeared, or exhibited significant brightness variations over time. Several candidate objects have been flagged for detailed follow-up analysis to determine their spectral characteristics and temporal behavior.

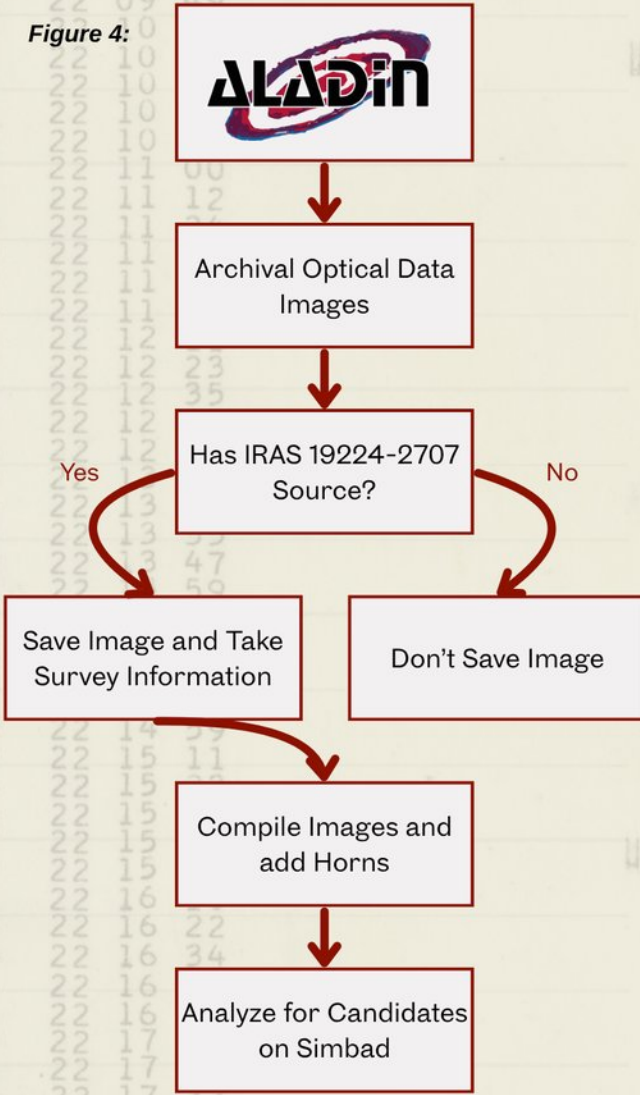
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Methodology

We conducted a systematic optical archival search using Aladin, a comprehensive astronomical database containing thousands of sky surveys spanning multiple decades. Our search focused on both Big Ear telescope horn regions, covering the potential Wow! Signal locations at coordinates RA 19h 25m 31s, Dec -26° 57' (positive horn) and RA 19h 28m 22s, Dec -26° 57' (negative horn) (Figure 3). We examined four major optical surveys: MAMA (1973-1986), DSS2 Blue (1975-1997), PanSTARRS (2009-2014), and DECaPS (2016-2019), ensuring coverage from before, during, and after the 1977 detection. Our systematic approach is outlined in **Figure 4**.



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