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Searching for T Dwarfs Within the Spitzer XFLS

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Abstract. One of the main advantages of the Spitzer Space Telescope are the Extragalactic and Galactic First Look Survey (XFLS, FLS) created during the first months of nominal operations. The IRAC instrument, especially, allowed simultaneous observations in multiple bands of these large areas of sky available to the astronomical community. We have decided to exploit the XFLS for a brown dwarf search, as well as the GFLS. In this paper, we report on the progress on our search within the XFLS.

Substellar Objects with IRAC

The Infrared Array Camera (IRAC; Fazio et al. 2004), on *Spitzer Space Telescope* (Werner et al. 2004) is a wonderful instrument for detecting substellar objects. Channel 1 & 2 were designed with the CH_4 absorption feature at 3μm and the 4.5μm flux peak of brown dwarfs in mind. A [3.5-4.6] color-color plot should bring the substellar objects to light right away (Figure 1a).

The Extragalactic First Look Survey

This study decided to look for brown dwarfs in the main field of the the Extragalactic First Look Survey (XFLS), one of the first observations made with the *Spitzer Space Telescope* after the completion of the Science Verification at the end of 2003. The XFLS covers 3.8 deg^2 centered on a low background region near the North Ecliptic Cap, within the Spitzer Continuous Viewing Zone (CVZ). Nine IRAC AORs were observed covering a 3x3 grid centered on R.A. (J2000) $17^h18^m00^s$, Dec.(J2000) $+59^\circ30'00''$ and reduced using the standard Spitzer Science Center (SSC) pipeline. The four channels were coadded offline (Figure 1b). Extensive ancillary catalogs have been produced by the FLS team including multi-wavelength ground based observations of the same field. The four IRAC single-band catalogs produced from each mosaic image (Lacy et al. 2005) were merged into a single 4-band catalogue which we have used to search for sources.

Search & Results

For the faintest objects, there may be only 4.5μm flux, therefore you are not sure if you have a spurious source, or a very late, cool brown dwarf. We have been very selective to make sure our candidate brown dwarfs are real and our

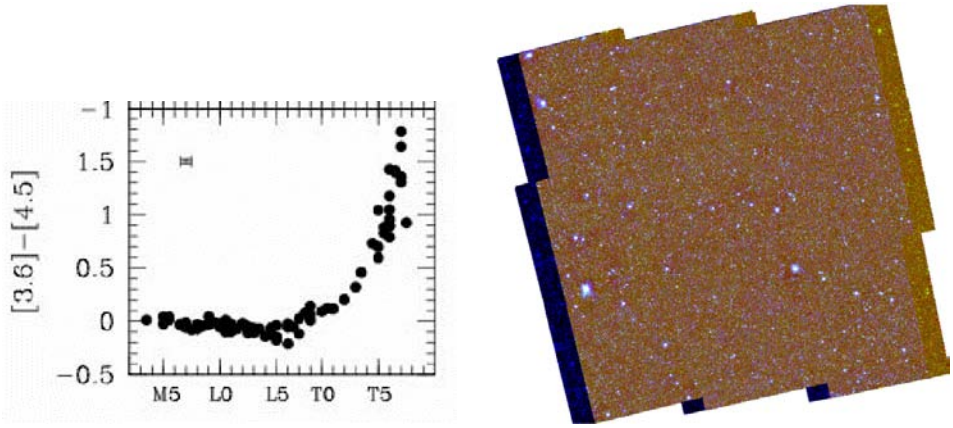

Figure 1. (a) IRAC color-color plot of substellar objects (Patten et al. 2004) (b)The main field the Extragalactic First Look Survey (XFLS). (data available at http://www.spitzer.caltech.edu)

candidate has 4.5μm and 5.8μm detections. (We therefore did not look for cool 500K objects with only 4.5μm fluxes.) From Monte Carlo simulations,(Padgett, O'Linger, & Staplefedlt 2003) the Legacy program SWIRE with a total area of 70 sq degrees is predicted to have between 10-20 foreground brown dwarfs depending on the mass function. The XLFS should thus have one or two.

A cross-correlation was run on the four channel catalog which looked for objects with only channel 2 & 3 fluxes, but no channel 1 flux. This would fall within the T dwarf colors, and the channel 3 flux would guarantee that the source was within the channel 1 field of view.

There were just less that 500 sources with channel 2 & 3 fluxes but no channel 1 flux. This could be for a myriad of reasons, as on the outskirts of the survey, or a channel 1 source not registered correctly in the catalog. We continue to search through these. Within this group, there were 78 sources which were bright enough at K to be found in the Two Micron All Sky Survey, but all have $0.8<J-K<1.8$, so are probably not L or T dwarfs.

The search for objects [3.6-4.5μm] > 2 turned up nothing, therefore we expect nothing cooler than a normal T dwarf among the remaining sources.

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References

Patten et al 2004 AAS 205, 11.10
Fazio et al. 2004 ApJL 154 10
Padgett,D., O.Linger, J., & K. Staplefedlt 2003, in IAU Symp 211, Brown Dwarfs, ed.E. Martin,(Waikoloa, Hawaii), 515
Lacy et al. 2005 ApJ submitted
Werner et al. 2004 ApJ 154 1