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on behalf of the Fermi LAT collaboration, and on behalf of the Fermi LAT Flare Advocates

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Abstract

The Flare Advocate/Gamma-ray Sky Watcher (FA-GSW) service supplies a prompt outlook to the Fermi LAT sky. During the first year many gamma-ray blazar flares, some unidentified transients and quiet sun emission were found.

The Flare Advocate Service

The Flare Advocate/Gamma-ray Sky Watcher (FA-GSW) activity is part of the Fermi LAT Science Operations aiming to supply a first and prompt human outlook service to the quick-look Automatic Science Processing (ASP) products (examples in Fig. 2,4,5) and in general to the Fermi gamma-ray sky and the detected sources, day by day. Fermi LAT is a all-sky survey monitor and the high-energy sky is often variable and transient, therefore the FA-GSW activity is performed with continuity for all the year through weekly shifts. The FA-GSW points out something potentially interesting and the first possible seeds for the different LAT science groups. The FA-GSW communicates basic and relevant news on the LAT sky also to the external astrophysical community (through the LAT-MW mailing-list, Astronomical Telegrams and the Fermi weekly blog), in order to promote and increase the rate of multi-frequency collaborations and observations, maximizing scientific return.

The role and activity of the FA-GSW is twofold:

1) **FA-side:** this is a role similar to the LAT burst-advocate (for GRBs). Sources exceeding $1E-6$ photons/cm²/s are always deserving attention. This activity is addressed to release internal fast notes, ATels, ToO triggers for multi-frequency observations, and to start possible ToO multi-frequency campaigns, LAT multi-frequency papers, and papers on single sources in general (with the possibility to be also a friend and contact person for a LAT source).

2) **GWS-side:** all the daily and 6h ASP process results are quickly inspected, looking at the detected LAT sources in the sky (Galactic and extragalactic source candidates), searching for flares and brightness trends, and for possible new candidate sources. For particularly interesting sources and possible new sources a likelihood check of detection, flux and spectral index is performed joined with the inspection of count maps, exposure maps and localization. A short daily internal report is compiled day by day and a short teleconference is performed every week. The Fermi sky blog (Fig. 6) is updated with the public weekly report. Finally software or other technical issues are also reported.

Fermi LAT Flare Advocates

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Table 1: the list of the main and deputy Flare Advocates (they are also Gamma-ray Sky Watchers, GSW, in general) that have performed at least one shift from Aug. 04, 2008 to Oct. 18, 2009.

Some results

FA-GSWs discovered many blazar flares and major outbursts, and some galactic plane transients. These discoveries in some cases led to papers (on single sources presenting LAT standalone data or LAT plus multi-frequency simultaneous observations). See for example the LAT papers on 3C 454.3, PKS 1454-354, PKS 1502+106 (Fig. 1), NGC 1275, 3C 279, PKS 1510-08. Some fast low galactic latitude transients are still un-associated to known sources (Fig.3).

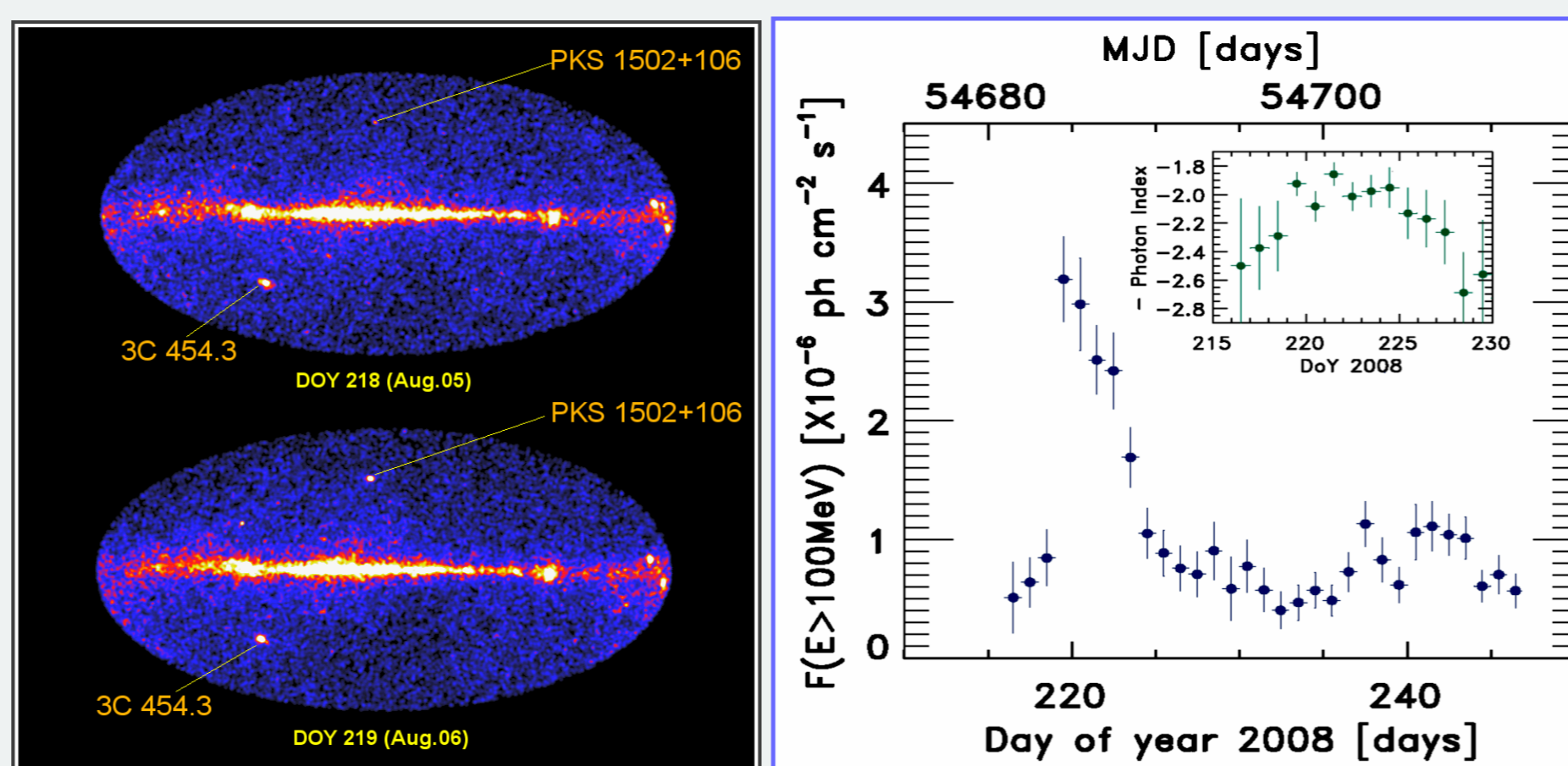


Figure 1: Left panel: ASP all-sky daily count maps showing the fast outburst of a gamma-ray source discovered during the first FA shift and later identified with the flat spectrum radio quasar PKS 1502+106. Right panel: likelihood flux (at $E>100$ MeV) light curve of PKS 1502+106 obtained by Fermi LAT and reported in daily time bins during August 2008 showing the asymmetric outburst.

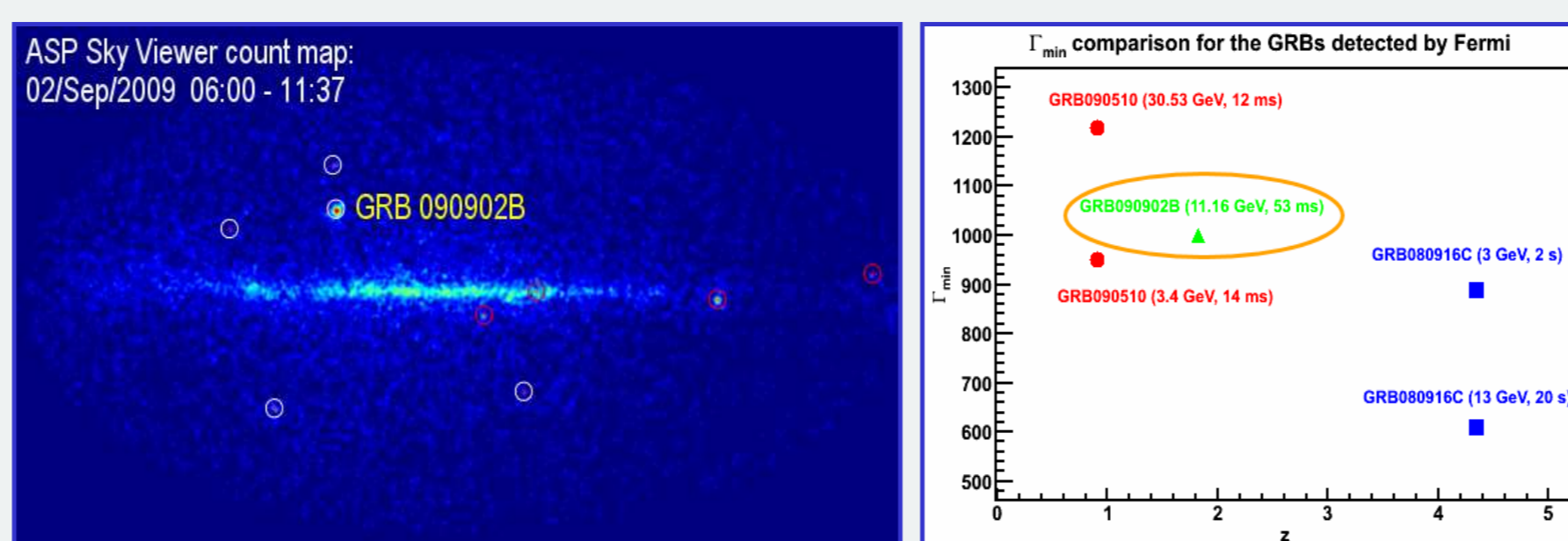


Figure 2: Left panel ASP all-sky daily image showing the Fermi LAT detected GRB 090902B well visible also in this sim 6h cumulated map. Right panel: the position of this blazar in the minimum Lorentz factor vs redshift scatter plot.

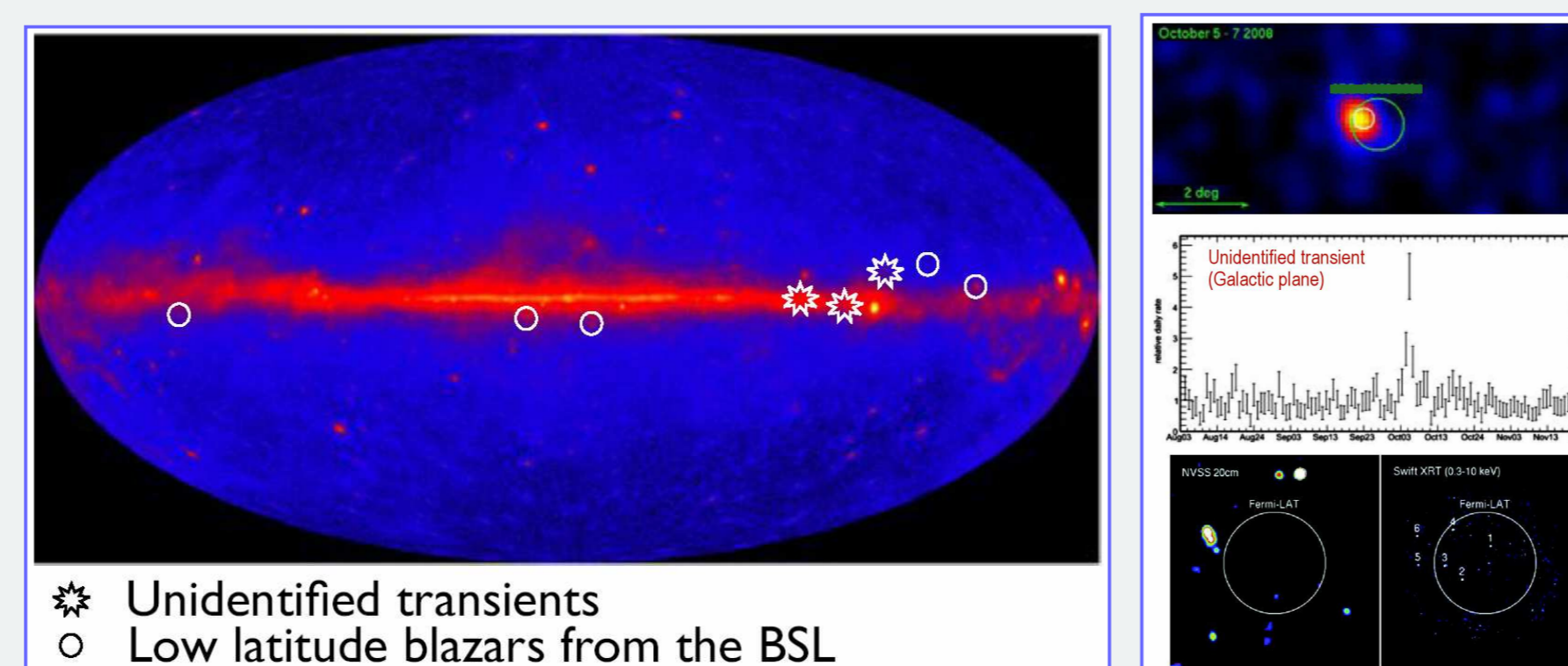


Figure 3: examples of Galactic plane fast transients. Left panel: some of these transients remained un-associated to both known galactic sources and blazar candidates. Right panels: 3-day smoothed count map, daily flux light curve, NVSS and Swift XRT maps with the superposed LAT error circle.

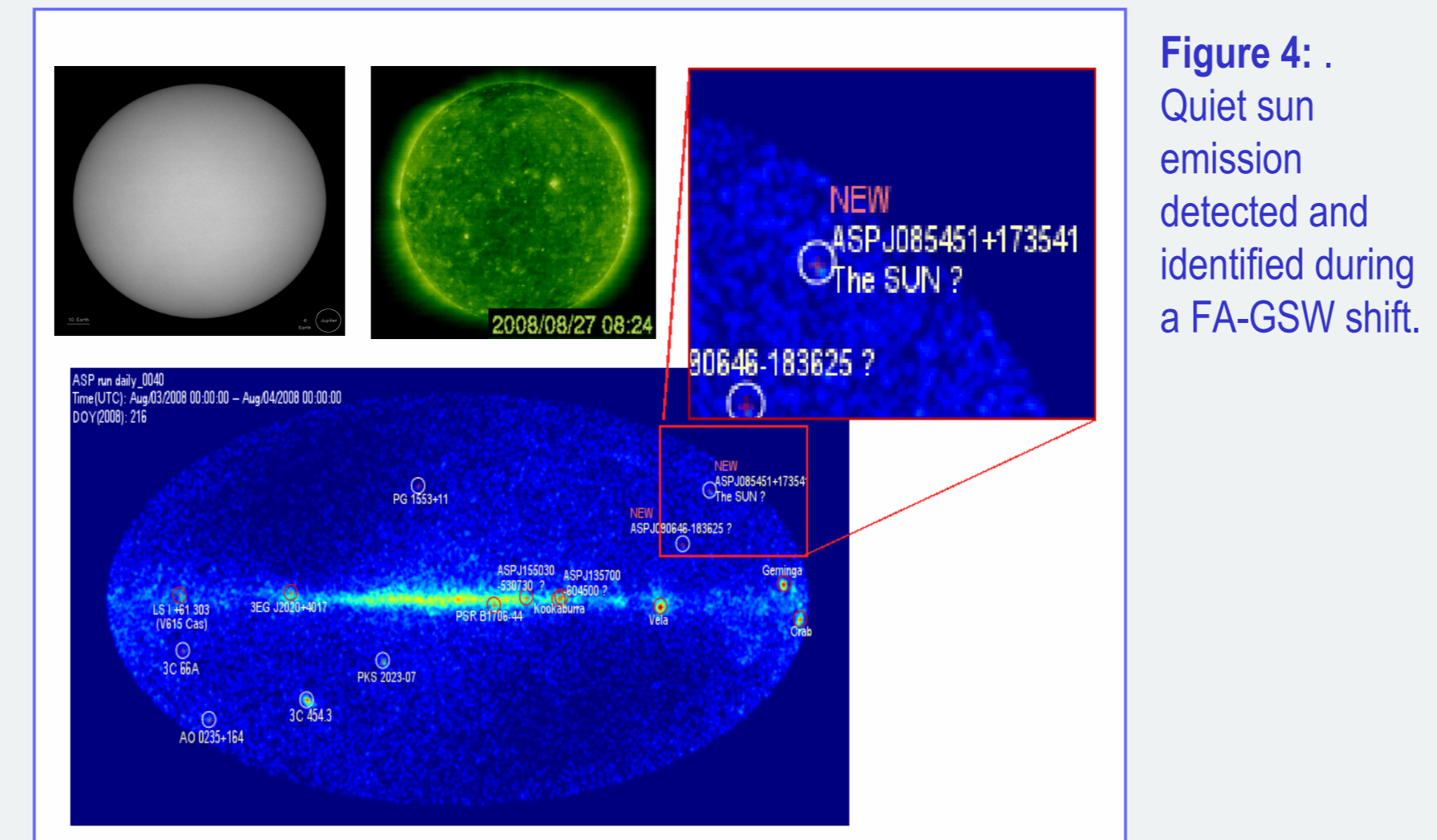


Figure 4: Quiet sun emission detected and identified during a FA-GSW shift.

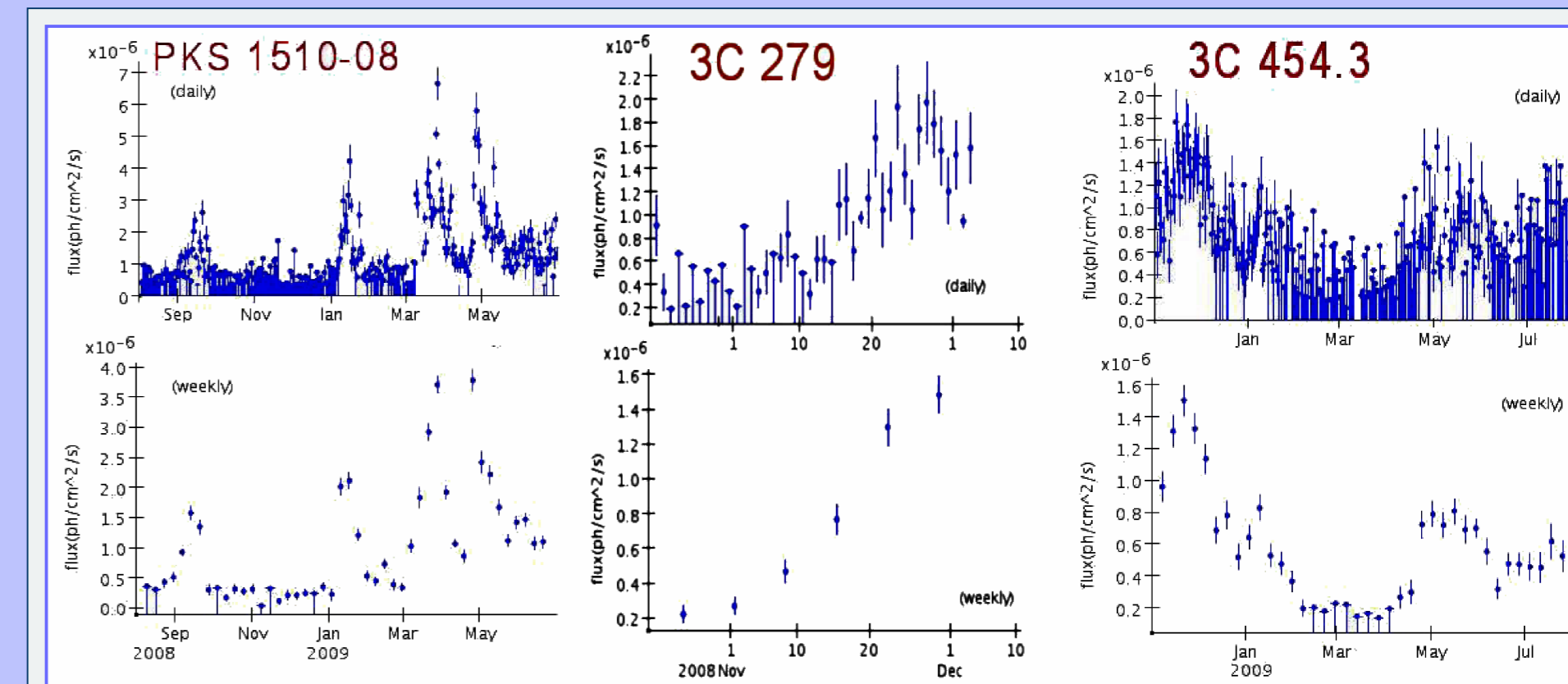


Figure 5: light curves of blazars produced by the ASP trending monitoring task. These light curves are only a first preliminary and automated quick-look to some LAT sources. The 3 examples reported here show already different behaviors (rapid pulse flares, monotonic slower trends, irregular oscillations).

Furthermore at beginning of this activity, also the quite-sun emission (not related to evident solar flares), almost continual in the LAT sky was discovered by the FA-GSW (Fig. 4).

In summary, during about the first year, 40 scientist of the LAT collaboration served as Flare Advocated (Table 1). In total 43 Astronomical Telegrams related to this activity were also published in this period, joined to daily internal reports, the additions to the public Fermi sky blog, and the summaries at the weekly teleconferences. More than a dozen of ToO were submitted to space observatories (Swift in particular) and radio-optical facilities. The FA-GSW activity is inherently also a multi-frequency job, starting from the quick-look association of daily sources through the exploit of multifrequency databases (ASDC, NED, CDS, HEASARC for example) to the work needed for multifrequency campaigns. Flare Advocate activities are important to getting the best science from Fermi LAT as demonstrated in Year-1, and are providing a unique service to the external multiwavelength community. Productivity and benefits for international scientific cooperation are therefore increasing thanks also to the Fermi LAT Flare Advocates.

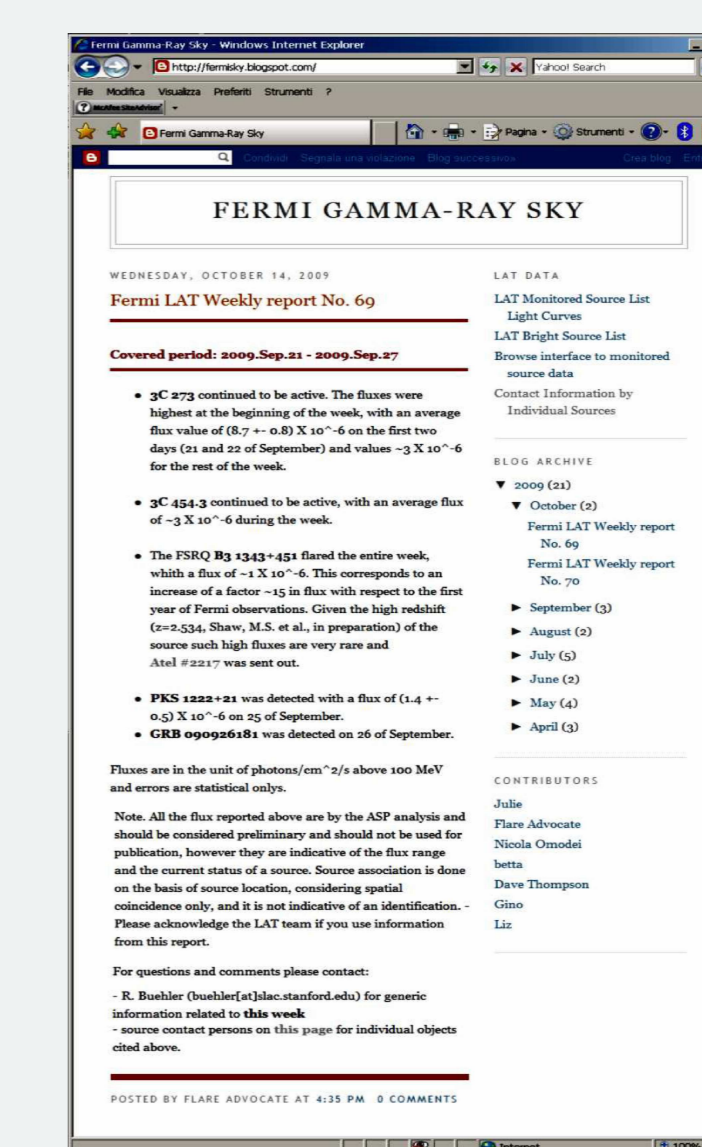


Figure 6: The Fermi Sky public Blog containing basic highlights about the evolving and transient gamma-ray sky seen by Fermi LAT week by week.



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