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Multi wavelength behavior of blazars in the AGILE era

S. Vercellone, on behalf of the AGILE Team

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Abstract. The AGILE γ-ray satellite accumulated data over two years on several blazars. Moreover, for all of the sources detected by AGILE, we exploited multi wavelength observations involving both space and ground based telescopes and consortia, obtaining in several cases broad-band spectral energy distributions (SEDs) which span from the radio wavelengths up to the TeV energy band.
I will review both published and yet unpublished AGILE results on γ-ray blazars, discussing their time variability, their γ-ray flare durations and the theoretical modeling of the SEDs. I will also highlight the GASP-WEBT and *Swift* fundamental contributions to the simultaneous and long-term studies of γ-ray blazars.

Key words. BL Lacertae objects: general – Quasars: general – Gamma rays: observations – Gamma rays: theory – Radiation mechanisms: non-thermal – Acceleration of particles

1. Introduction

Multi wavelength studies of γ-ray active galactic nuclei (AGNs) date back to the late '70s and the early '80s with the COS–B detection of 3C 273 (Swanenburg et al. 1978; Bignami et al. 1981). Nevertheless, the paucity of extragalactic γ-ray source detected by SAS-2 and COS-B prevented systematic multi frequency studies. It was during the '90s, with the launch of CGRO, that EGRET allowed to establish blazars as a class of γ-ray emitters and to start multi wavelength studies of such sources. For a few sources, it was possible to study both the properties of the SEDs during different γ-ray states, and the search for correlated variability at different bands, as for 3C 279 (Hartman et al. 2001a,b).

The recent launches of the AGILE and *Fermi* satellites allowed the blazar community to observe a large fraction of the sky above 100 MeV, thanks to their wide ($\sim$ 3 sr) field of view (FoV), and to start a more effective multi wavelength approach in their spectral energy distribution investigation.

In the following, I will briefly introduce the AGILE satellite, and then I will focus on the AGILE results on the studies of γ-ray blazars. Particular emphasis will be given to the importance of simultaneous (or at least, coordinated) multi wavelength observations, in order to study both the broad-band properties, and the correlations between the emission at different frequencies.

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2. The AGILE mission

The launch of the AGILE satellite in April 2007 (Tavani et al. 2009) allowed us to efficiently monitor, between 30 MeV and 30 GeV, several objects during the same pointing, thanks to the 3 sr FoV of the Gamma-Ray Imaging Detector (GRID), and -for the first time- to simultaneously monitor the central steradian of the GRID FoV in the 18–60 keV energy band, by means of the Super–AGILE detector.

The AGILE scientific instrument is very compact and combines four active detectors yielding broad-band coverage from hard X-rays to gamma-rays: a Silicon Tracker (ST; Prest et al. 2003, 30 MeV–30 GeV), a co-aligned coded-mask hard X-ray imager (SA; Feroci et al. 2007, 18–60 keV), a non-imaging CsI Mini–Calorimeter (MCAL; Labanti et al. 2009, 0.3–100 MeV), and a segmented Anti-Coincidence System (ACS; Perotti et al. 2006).

3. The AGILE multi wavelength approach

Most of the AGILE campaigns were coordinated with other observatories at different wavelengths, such as *Spitzer*, *Swift*, *Suzaku*, INTEGRAL, RXTE, MAGIC, VERITAS, the WEBT Consortium, and REM.

This approach, based on pre-approved target of opportunity (ToO) guest investigator (GI) proposals, Director discretionary time (DDT) requests, monitoring programs, and bilateral agreements, allowed the AGILE Team to obtain truly simultaneous data on specific sources, covering the entire blazar spectral energy distribution, from 10^9 to 10^{26} Hz.

In particular, in order to obtain an as dense as possible optical coverage of γ-ray sources during the AGILE observations, we established a tight and fruitful collaboration with the GLAST-AGILE Support Program (GASP) organized within the Whole Earth Blazar Telescope (WEBT), which provides radio-to-optical long-term continuous monitoring of a list of selected γ-ray -loud blazars.

Moreover, in order to monitor the synchrotron to inverse Compton region of the SED, the most effective satellite in orbit is *Swift*, because of its rapid reaction to ToO requests (of the order of a few hours) and because of its broad-band coverage, from the optical-UV, the soft X-rays, up to the hard X-rays. Several GI programs and ToO observations were performed, for a total of a few hundreds ksec.

4. AGILE blazar properties

During the first two years of operations AGILE detected several blazars in a high γ-ray state. Table 1 lists the blazars detected so far with their main properties and references.

Among AGNs, blazars show intense and variable γ-ray emission above 100 MeV (Hartman et al. 1999). Variability timescale can be as short as few days, or last a few weeks. The peak of the γ-ray emission can reach very high fluxes, comparable to the flux of the Vela pulsar. Moreover, since they emit across several decades of energy, from the radio to the TeV energy band, they are the perfect candidates for simultaneous observations at different wavelengths.

Therefore, thanks to the AGILE wide FoV, we can monitor on a long time scale several objects at the same time, studying both their variability behavior and their emission at different bands. We can study the properties of the AGILE sample addressing the following subjects: γ-ray variability and flaring duration, SED modeling, and time lags between the emissions at different wavelengths.

4.1. γ-ray variability and flaring duration

Variability is a common feature in blazars, especially at high energy, where a factor of 10 is not uncommon, even at short time scale (e.g. PKS 1622−297, Mattox et al. 1997).

AGILE observations showed different behaviors among γ-ray blazars. Some of them show no degree of variability, independently of their γ-ray flux level above 100 MeV. Among high ($F_{\gamma} > 200 \times 10^{-8}$ photons cm^{-2} s^{-1})

Table 1. List of the AGILE flaring blazars. The numbers in boldface in the Reference column designate papers submitted and/or in preparation. *References*: 1. Chen et al., 2008, A&A, 489, L37; 2. Vittorini et al., 2009, ApJL, submitted; 3. Giommi et al., 2008, A&A, 487, L49; 4. Donnarumma et al., 2009, ApJL, 691, 13; 5. Acciari et al., 2009, in preparation; 6. Pucella et al., 2008, A&A, 491, L21; 7. D'Ammando et al., 2009, A&A, accepted; 8. D'Ammando et al., 2009, in preparation 9. Pacciani et al., 2009, A&A, 494, 49; 10. Giuliani et al., 2009, A&A, 494, 509; 11. Vercellone et al., 2008, ApJL, 676, 13; 12. Wehrle et al., 2010, in preparation; 13. Vercellone et al., 2009a, ApJ, 690, 1018; 14. Donnarumma et al., 2009, ApJ, submitted; 15. Vercellone et al., 2009b, in preparation; 16. Pucella et al., 2009, in preparation.

Name	Period *start : stop*	Sigma	ATel #	Ref.
S5 0716+714	2007-09-04 : 2007-09-23	9.6	1221	1, **2**
	2007-10-24 : 2007-11-01	6.0	-	3
MRK 0421	2008-06-09 : 2008-06-15	4.5	1574, 1583	4
W Comae	2008-06-09 : 2008-06-15	4.0	1582	**5**
PKS 1510−089	2007-08-23 : 2007-09-01	5.6	1199	6
	2008-03-18 : 2008-03-20	7.0	1436	**7**
	2009-03-01 : 2009-03-31	19.9	1957, 1968, 1976	**8**
3C 273	2007-12-16 : 2008-01-08	4.6	-	9
3C 279	2007-07-09 : 2007-07-13	11.1	-	10
3C 454.3	2007-07-24 : 2007-07-30	13.8	1160, 1167	11, **12**
	2007-11-10 : 2007-12-01	19.0	1278, 1300	13
	2007-12-01 : 2007-12-16	21.3	-	**14**
	2008-05-10 : 2009-01-12	17.9	1545, 1581, 1592, 1634	**15**
PKS 0537−441	2008-10-10 : 2008-10-17	5.5	-	**16**

γ-ray flux sources, 3C 279 (Giuliani et al. 2009), and 3C 454.3 (Vercellone et al. 2008) were almost constant during a one-week long observation. Among low ($F_\gamma < 100 \times 10^{-8}$ photons cm^{-2} s^{-1}) γ-ray flux sources, 3C 273 (Pacciani et al. 2009), MKN 421 (Donnarumma et al. 2009a), PKS 0537−441 (Pucella et al. 2009a), and S5 0716+714 in October 2007 (Giommi et al. 2008) showed no clear sign of variability during the AGILE observations.

Fig. 1 shows the July 2007 γ-ray light curve of 3C 454.3 as an example of a basically steady source during a high γ-ray state.

AGILE detected 3C 454.3 during a dedicated target of opportunity (ToO) activated immediately after an extremely bright optical flare, in mid July 2007, just at the completion of the satellite science verification phase. In Vercellone et al. (2008) we report a detailed analysis of this first detection. During a 6-day observation, the average γ-ray flux was $F_{\rm E>100\,MeV} = (280 \pm 40) \times 10^{-8}$ photons cm^{-2} s^{-1}, more than a factor of two higher than the maximum value reported by EGRET. Since this detection, this source became the most luminous object of the AGILE sky.

On the other side, γ-ray variability can be as fast as one or two days, as shown in Fig. 2. S5 0716+714, an intermediate BL Lac object, was observed by AGILE during a 3-week long campaign in September 2007, as discussed in Chen et al. (2008). The flaring activity appeared to be very fast, with an increase of the γ-ray flux by a factor of four in three days. The average γ-ray flux was the highest ever recorded for this object, $F_{\rm E>100\,MeV} \simeq 100 \times 10^{-8}$ photons cm^{-2} s^{-1}, reaching a peak value about twice as high.

A few sources displayed long γ-ray activity time scales, such as 3C 454.3. During

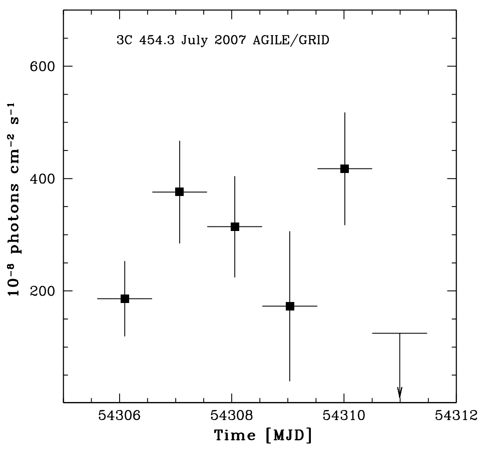

Fig. 1. Light curve of 3C 454.3 above 100 MeV during the AGILE campaign in July 2007 (Adapted from Vercellone et al. 2008).

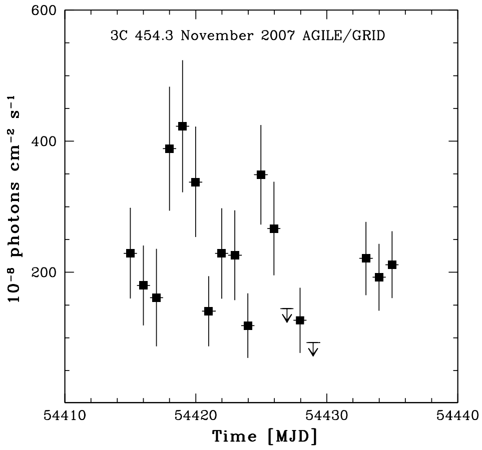

Fig. 3. 3C 454.3 light curve above 100 MeV during the AGILE campaign in November 2007 (Adapted from Vercellone et al. 2009a).

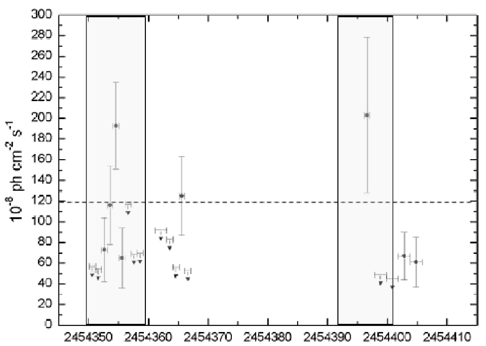

Fig. 2. Light curve of S5 0716+714 above 100 MeV during the AGILE campaign in September 2007 (Adapted from Chen et al. 2008).

2007, this source was constantly detected by AGILE in a high state from November to December, showing variability on a time scale of 24–48 hours (Vercellone et al. 2009a; Donnarumma et al. 2009b), and deserving for this behavior the nick-name of *Crazy Diamond*. Fig. 3 shows the highly-variable long-lasting November 2007 γ-ray light curve for 3C 454.3, yielding an average γ-ray flux over the entire campaign of $F_{\mathrm{E}>100\,\mathrm{MeV}} = (170 \pm 13) \times 10^{-8}$ photons cm^{-2} s^{-1}.

In 2008, this source was monitored by AGILE starting from May until January 2009, and its average γ-ray flux remained above $F_{\mathrm{E}>100\,\mathrm{MeV}} \simeq 150 \times 10^{-8}$ photons cm^{-2} s^{-1}, from May until October (Vercellone et al. 2009b), displaying variability on a day-by-day time scale.

Another example of extremely variable source on a monthly time scale is PKS 1510−089. Before the AGILE campaign during March 2009, this source was detected twice: in August 2007 (Pucella et al. 2008) at an average γ-ray flux $F_{\mathrm{E}>100\,\mathrm{MeV}} = (195 \pm 30) \times 10^{-8}$ photons cm^{-2} s^{-1} in the period August 23 - September 1; subsequently, in March 2008, the source was clearly detected by AGILE at a significance level of about 7–σ, and at an average flux level over the entire period of $F_{\mathrm{E}>100\,\mathrm{MeV}} \sim 130 \times 10^{-8}$ photons cm^{-2} s^{-1} (D'Ammando et al. 2009a). The AGILE March 2009 campaign caught this source in a very active state, showing three distinct γ-ray flares reaching peak fluxes above $F_{\mathrm{E}>100\,\mathrm{MeV}} \sim 400 \times 10^{-8}$ photons cm^{-2} s^{-1} (D'Ammando et al. 2009b; Pucella et al. 2009b; Vercellone et al. 2009c). This long-lasting highly-variable campaign will be presented in a forthcoming paper (D'Ammando et al. 2009c).

4.2. Time lags

The simultaneous multi wavelength monitoring of selected blazars, in particular in the optical *R* band by means of the GASP project, allowed us to study the correlations and the possible time lags between the emission in the two energy bands. Two sources were studied in detail, S5 0716+714 and 3C 454.3.

S5 0716+714 was monitored simultaneously by AGILE and by the GASP-WEBT during Fall 2007 (Chen et al. 2008). The discrete correlation function (DCF, Edelson & Krolik 1988) was applied to the optical and γ-ray data. A DCF peak at $\tau = -1$ day shows a possible delay of the γ-ray flux variations with respect to the optical one. A possible interpretation, within the synchrotron self-Compton (SSC) model which fit the source data, is that the 1-day time lag in the γ-ray peak emission could be due to the light travel time of the synchrotron seed photons that scatter the energetic electrons.

The DCF method was applied to the November 2007 observing campaign of 3C 454.3, during which simultaneous optical (GASP-WEBT and REM) and AGILE γ-ray data were used to study the possible correlation in the two bands. As reported in Vercellone et al. (2009a), The DCF peak occurred at $\tau = 0$, and its value is < 0.5. This indicates a moderate correlation, with no significant time delay between the γ-ray and optical flux variations.

During the December 2007 campaign on 3C 454.3, Donnarumma et al. (2009b) found a possible time delay of the γ-ray flux variations with respect to the optical one of less than 1 day ($\tau = 0.5 \pm 0.6$ day), by an accurate analysis of the December 12 optical and γ-ray flares. This result is consistent with the typical blob dimension and the corresponding crossing time of the external seed photons in an external Compton (EC) model for the second peak in the source SED. Similar results were obtained by Bonning et al. (2009) by means of the analysis of the simultaneous optical (SMARTS) and γ-ray (*Fermi*) data.

4.3. SED modeling

According to Fossati et al. (1998) and Ghisellini et al. (1998) there should be a sequence between the *average* SEDs of different blazar categories, based on the different power of the sources, which increases from the high-peaked BL Lac objects (the less powerful ones) to the flat-spectrum radio quasars (the most powerful ones), and the power of the external radiation field (weakest in the former ones, highest in the latter ones).

AGILE detected at least one object for each blazar category: 3C 454.3 (flat-spectrum radio quasar, FSRQ), PKS 0537−441 (low-peaked BL Lac object, LBL), S5 0716+714 (intermediate BL Lac object, IBL), and MKN 421 (high-peaked BL Lac object, HBL). Therefore, we were able to perform detailed studies of simultaneous SEDs for blazars belonging to different sub-classes, and to investigate their emission mechanisms.

4.3.1. Flat-spectrum radio quasars

3C 454.3 is the typical prototype the FSRQ class. During the strong optical and X-ray flare which occurred on May 2005, its SED was investigated by several groups (Giommi et al. 2006; Pian et al. 2006; Villata et al. 2006; Raiteri et al. 2007), but no γ-ray satellite was operative at that time.

AGILE detected 3C 454.3 during a dedicated ToO activated immediately after a bright optical flare, in mid July 2007. Following a report by Vercellone et al. (2007) about the preliminary analysis of the γ-ray data, Ghisellini et al. (2007) compared 3C 454.3 SEDs obtained at three different epochs (2000, 2005, and 2007), speculating that their difference could be due to the different location of the dissipation site (larger in 2000 and 2007), and different values of the magnetic field and Lorentz factor.

In November 2007, Vercellone et al. (2009a) discussed the SEDs computed dur-

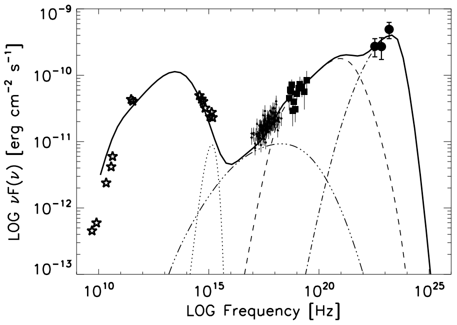

Fig. 4. 3C 454.3 SED during the AGILE campaign in November 2007 (Adapted from Vercellone et al. 2009a). The dotted, dashed, dot–dashed, and the triple–dot dashed lines represent the accretion disk, the external Compton on the disk radiation, the external Compton on the broad line region radiation, and the SSC contributions, respectively.

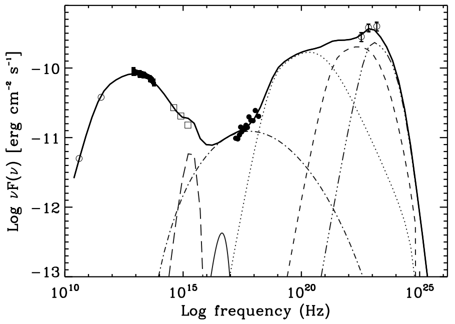

Fig. 5. 3C 454.3 SED during the AGILE campaign in December 2007 (Adapted from Donnarumma et al. 2009b).

ing two high ($F_{\rm E>100\,MeV}$ > 300×10^{-8} photons cm^{-2} s^{-1}) γ-ray states. Fig. 4 shows the almost simultaneous SED of the blazar 3C 454.3 across 14 decades in energy, acquired during one of this periods, precisely between MJD 54423.5 and MJD 54426.5. The SED modeling indicates that the contribution of the external Compton scattering of direct disk radiation (ECD) can account for the soft and hard X-ray portion of the spectrum, which shows only a moderate time variability. However, we note that the ECD component alone cannot account for the hardness of the γ-ray spectrum. We therefore argue that above 100 MeV, a dominant contribution from the external Compton scattering from broad-line region clouds (ECC) seems to provide a better fit of the data during the γ-ray flaring states.

During the December 2007 campaign, Donnarumma et al. (2009b) investigated the broad-band characteristics of 3C 454.3 also by means of *Spitzer* and *Suzaku* observations. The former ones are very important, since they cover the synchrotron peak, while the AGILE data cover, simultaneously, the IC peak. Fig. 5 shows the source SED on 2007 December 13, when the source was at an intermediate ($F_{\rm E>100\,MeV} \sim 200 \times 10^{-8}$ photons cm^{-2} s^{-1}) γ-ray flux level. In order to account for the hard γ-ray spectrum and the relative lower value ($\sim$ 300) of the electron break Lorentz factor with respect to the November 2007 one ($\sim$ 500), a hot corona component surrounding the jet is added to the SED modeling, since this particular energetic regime seems to make the BLR photons a too soft contributor at GeV energies.

Further important FSRQs detected by AGILE are 3C 273, 3C 279, and PKS 1510−089.

AGILE detected 3C 273 during a pre–planned 3-week campaign between December 2007 and January 2008, with simultaneous INTEGRAL, RXTE, *Swift*, and REM coverage, and it was the first source detected simultaneously by the AGILE/GRID and by Super–AGILE (Pacciani et al. 2009). The SED is consistent with a leptonic model where the soft X-ray emission is originated from a combination of SSC and external Compton models, while the hard X-ray and γ-ray emission is compatible with external Compton from thermal photons of the disk.

3C 279 is the first extragalactic source ever detected by AGILE in the γ-ray energy band, in July 2007. The almost simultaneous observations of 3C 279 by means of *Swift*/XRT and REM, allowed us to investigate the SED and to compare it to previous SEDs reported in Hartman et al. (2001a). As shown in Giuliani et al. (2009), we note that a soft γ-ray spectrum ($\Gamma_{\rm AGILE}$ = 2.22 ± 0.23) can be understood in terms of a low state of the ac-

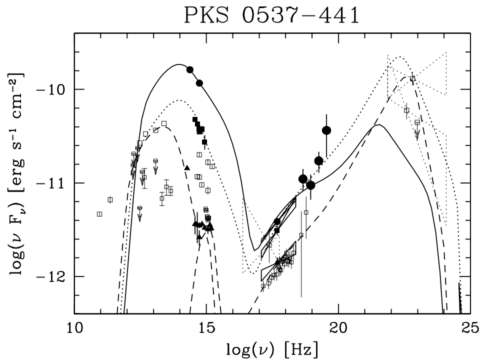

Fig. 6. PKS 0537−441 SED during the multi wavelength campaign in 2005 (From Pian et al. 2007).

cretion disk before the γ-ray observations, suggesting a dominant contribution of the external Compton of direct disk radiation compared to the external Compton scattering of the broad–line region clouds.

The AGILE detection of PKS 1510−089 is a clear example of the importance of a wide field of view for detecting γ-ray transients. During the August 2007 observation, as reported in Pucella et al. (2008), a simultaneous WEBT monitoring of this source allowed us to investigate the SED, which results to be consistent with a leptonic model where the external Compton scattering of the broad–line region clouds can account for the γ-ray emission.

4.3.2. Low-peaked BL Lac objects

According to its spectral energy distribution PKS 0537−441 belongs to the low peaked BL Lac objects. Strong and broad emission lines of Lyα and C IV were observed by means of HST, and allowed Pian et al. (2002) to derive the redshift of the source at $z = 0.896 \pm 0.001$. At this redshift the inferred properties of PKS 0537−441 place it among the most luminous LBL objects. Fig. 6 shows the historical SED collected by Pian et al. (2007).

AGILE detected PKS 0537−441 between October 10 and 17, 2008. We also activated a multi wavelength campaign involving *Swift* (between October 8 and 17), and REM (October 7, 8, and 9). The results of this campaign will appear in a forthcoming paper (Pucella et al. 2009a).

4.3.3. Intermediate BL Lac objects

Among this blazar sub-class, S5 0716+714 was a particularly successful target for AGILE. Its SED properties were discussed in detail in two recent papers. Chen et al. (2008) discussed the γ-ray and optical data collected in the period 2007 September 7–12, during which the γ-ray flux was very high ($F_{\mathrm{E>100\,MeV}} = (97 \pm 15) \times 10^{-8}$ photons cm^{-2} s^{-1}), with a peak flux about twice as high. The time lag between the γ-ray and the optical flux variations (discussed in Section 4.2), and the fact that the γ-ray variability appears to depend on the square of changes in optical flux density, seem to favour a SSC interpretation of the SED, in which the emission at the synchrotron and IC peaks is produced by the same electron population, which self-scatters the synchrotron photons, with the caveat that two SSC components are needed to account for the source variability.

A similar modeling was used by Giommi et al. (2008) in order to reproduce the source SED in the period 2007 October 23 - November 1. Fig. 7 shows the multi wavelength SED obtained with AGILE and *Swift* data. The authors found that the

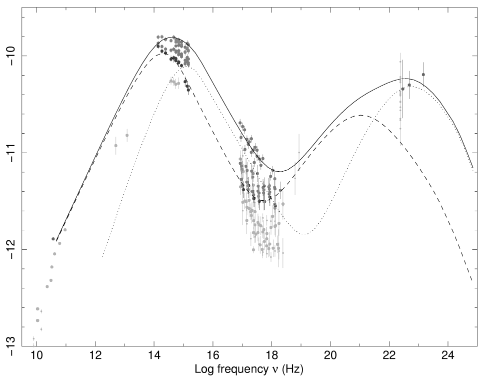

Fig. 7. S5 0716+714 SED during the multi wavelength campaign in October 2007 (From Giommi et al. 2008).

optical and soft X-ray fluxes had different variability behavior, and that the 4–10 keV emission remained almost constant during the observations. The different variability behavior observed in different parts of the SED may be interpreted as due to the sum of two SSC components, one of which is constant while the other is variable.

Another very important result obtained by the analysis of the γ-ray data is discussed in Vittorini et al. (2009) where, assuming the recently measured redshift of this source ($z = 0.31 \pm 0.08$) by Nilsson et al. (2008), they conclude that this source is among the brightest BL Lacs ever detected at γ-ray energies, with negligible disk contribution. Because of its high power and lack of signs for ongoing accretion, they argue that during the 2007 γ-ray flares S5 0716+714 approached (or just exceeded) the maximum power that can be extracted from a Kerr black hole by means of the Blandford-Znajek mechanism (Blandford & Znajek 1977).

4.3.4. High-peaked BL Lac objects

Due to their particular SEDs, this blazar subclass is less easy to be detected by γ-ray telescopes optimized in the energy range 0.1–1 GeV, such as EGRET and AGILE.

AGILE detected two HBLs during a dedicated ToO towards W Comae, following a flare in the TeV energy band (Swordy 2008): W Comae and MKN 421.

The latter triggered an immediate multi wavelength campaign involving AGILE, *Swift*, RXTE, GASP-WEBT, MAGIC, and VERITAS. The Super–AGILE monitor detected a fast flux increase from the source (Costa et al. 2008) up to 40 mCrab in the 15–50 keV energy band, about a factor of 10 higher than its typical flux in quiescence. A *Swift* ToO was immediately obtained and the observed flux was as high as $F_{2-10\,\mathrm{keV}} = 2.56 \times 10^{-9}$ erg cm^{-2} s^{-1}. The results of an extensive multi wavelength campaign are discussed in Donnarumma et al. (2009a). Fig. 8 shows the MKN 421 SED collected during the high-energy flare. For the first time, simultaneous MeV–GeV (AGILE) and TeV (MAGIC and VERITAS) data allow us to study in an unprecedented detail the inverse Compton region of the SED, while WEBT, *Swift*, and RXTE data provide coverage of the synchrotron region. The analysis of the SED shows that the γ-ray flare can be interpreted within the framework of the SSC model in terms of a rapid acceleration of leptons in the jet.

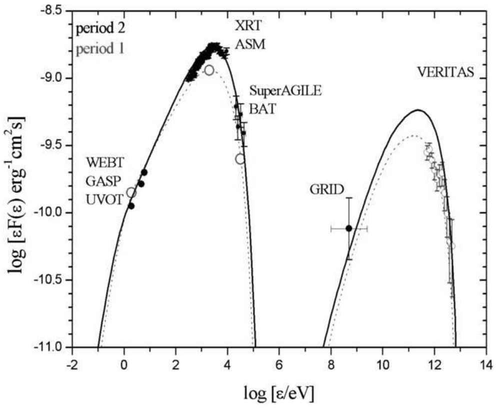

Fig. 8. MKN 421 SED during the multi wavelength campaign in June 2008 (From Donnarumma et al. 2009a).

5. Conclusions

During its first year of sky monitoring, AGILE demonstrated the importance of its wide ($\sim$ 3 sr) field of view in detecting transient sources at high off-axis angles. Moreover, its unique combination of a γ-ray detector with a hard X-ray monitor allowed us to study in detail the high energy portion of the blazar SEDs.

The synergy between the AGILE wide field of view, its fast response to external triggers, and the availability of a network of ground-based telescopes, allowed us to obtain a multi wavelength coverage for almost all the detected sources, and to investigate the physics of different classes of blazars.

Moreover, by means of long-term studies of selected objects, we were able to monitor both high and low γ-ray states of different sources.

Finally, archival data analysis is in progress, and we start detecting dim and steady sources (Pittori et al. 2009).

6. DISCUSSION

JIM BEALL: Can you say again what the delay is between the optical and the γ-ray for 3C 454.3?

STEFANO VERCELLONE: The November 2007 correlation analysis is consistent with no time-delay between the γ-ray and the optical flux variations. Moreover, both the analysis of the December 2007 data and of the whole November–December 2007 campaign seem to suggest a possible delay of the γ-ray emission with respect to the optical one of the order of less than one day, but still statistically compatible with no time-lag.

BIDZINA KAPANADZE: I wanted to ask you about TeV blazars. One observes a shift of the peak frequency to higher or lower energies when the source varies. Is such shift detected?

STEFANO VERCELLONE: Although AGILE does not have at the moment a large number of TeV blazars already detected, we do see this trend. For example, the analysis of the August 2007 detection of S5 0716+714, recently confirmed by MAGIC as a TeV blazar (see Paredes, this Workshop), shows a shift of both the synchrotron and the inverse Compton peaks towards higher frequencies during the intense γ-ray flare reported by AGILE.

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