Multi-wavelength observations of the high-redshift blazar 4C +71.07

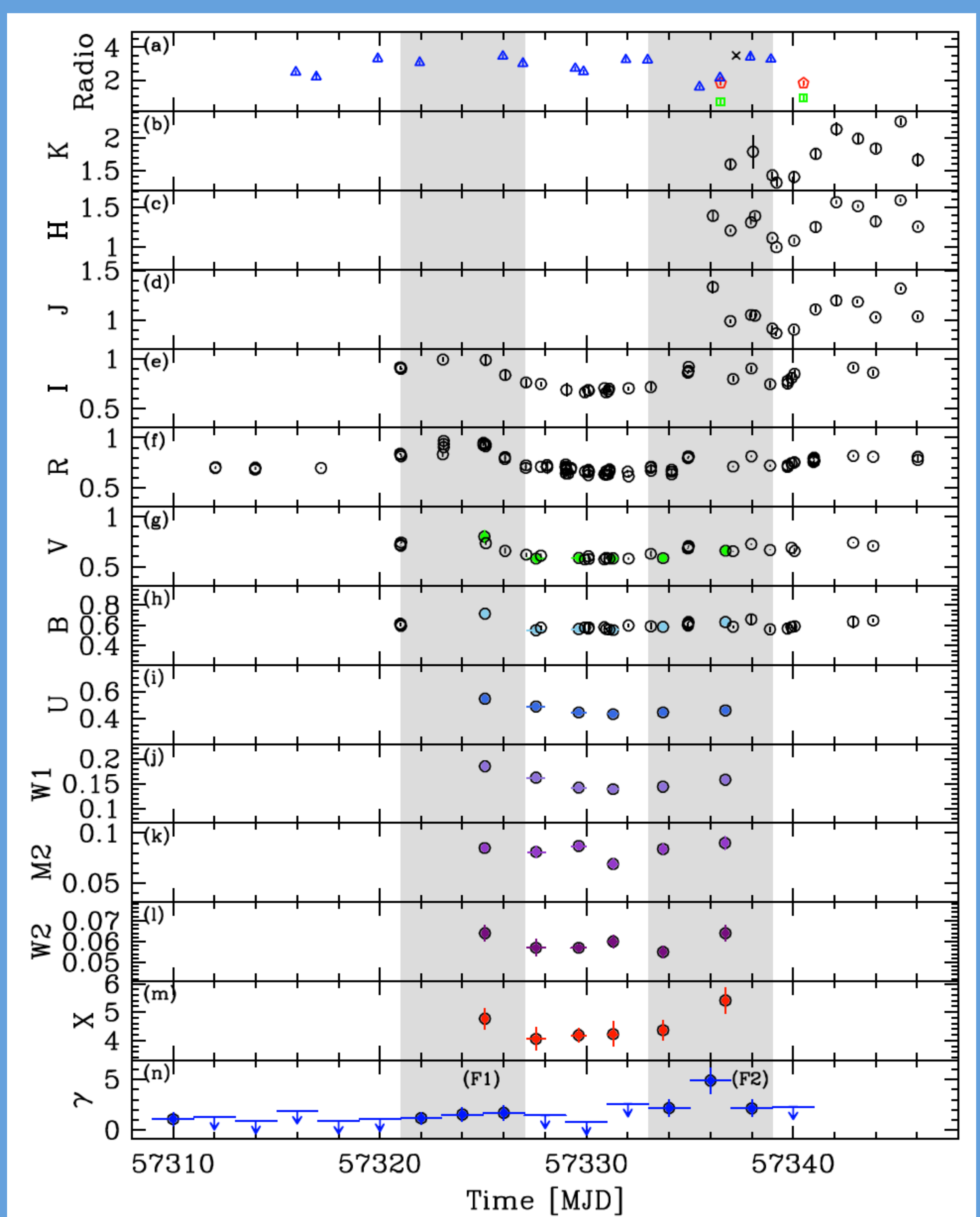
S. Vercellone (INAF/OAB)
on behalf of a larger collaboration.
A&A, to be submitted

Abstract

The flat-spectrum radio quasar 4C +71.07 has been detected by the AGILE gamma-ray satellite on 2015 October 27-29 and 2015 November 08-10, when it reached a gamma-ray flux of the order of 1.2×10^{-6} ph cm^{-2} s^{-1} and 3.1×10^{-6} ph cm^{-2} s^{-1}, respectively. Because of its relatively high redshift (z=2.172), this blazar shows a prominent accretion disc bump peaking in the ultra-violet band, which makes this source an excellent candidate to investigate not only the jet emission but also the non thermal one. **We investigated its spectral energy distribution by means of almost simultaneous observations covering the cm, mm, near-infrared, optical, ultra-violet, X-ray and gamma-ray energy bands** obtained by the GASP-WEBT Consortium, *Swift*, and the AGILE satellites. **We present the spectral energy distribution of the gamma-ray flare whose energy coverage is more dense, modeling it by means of a one-zone leptonic model.**

Observations

Multi-λ light-curves for the observing campaign on 4C +71.07.



Panel (a): GASP-WEBT 5GHz (black cross sign), 37GHz (blue triangles), 86GHz (red diamonds), and 228 GHz (green squares) data [Jy].
Panels (b)–(h): K, H, J, I, R, V, B bands (open circles, [mJy]).
Panels (g)–(l): Swift/UVOT v, b, u, w1, m2, w2 bands (coloured discs, [mJy]).
Panel (m): Swift/XRT observed 0.3–10 keV flux [10^{-11} erg cm^{-2} s^{-1}].
Panel (n): AGILE/GRID data (E > 100MeV, [10^{-6} photons cm^{-2} s^{-1}]).

The **grey-dashed areas** mark the time-interval (**F1**, MJD 57321.0–57327.0; **F2**, MJD 57333.0–57339.0) used for accumulating the almost simultaneous SEDs (orange and black symbols, respectively).

Results

Spectral energy distribution for flares **F1** and **F2** of 4C +71.07 (time intervals as reported in the left panel). Orange symbols refer to the first flare (**F1**), while black symbols to the second one (**F2**). Small grey points are archival data provided by *the ASI/ ASDC SED Builder Tool.*

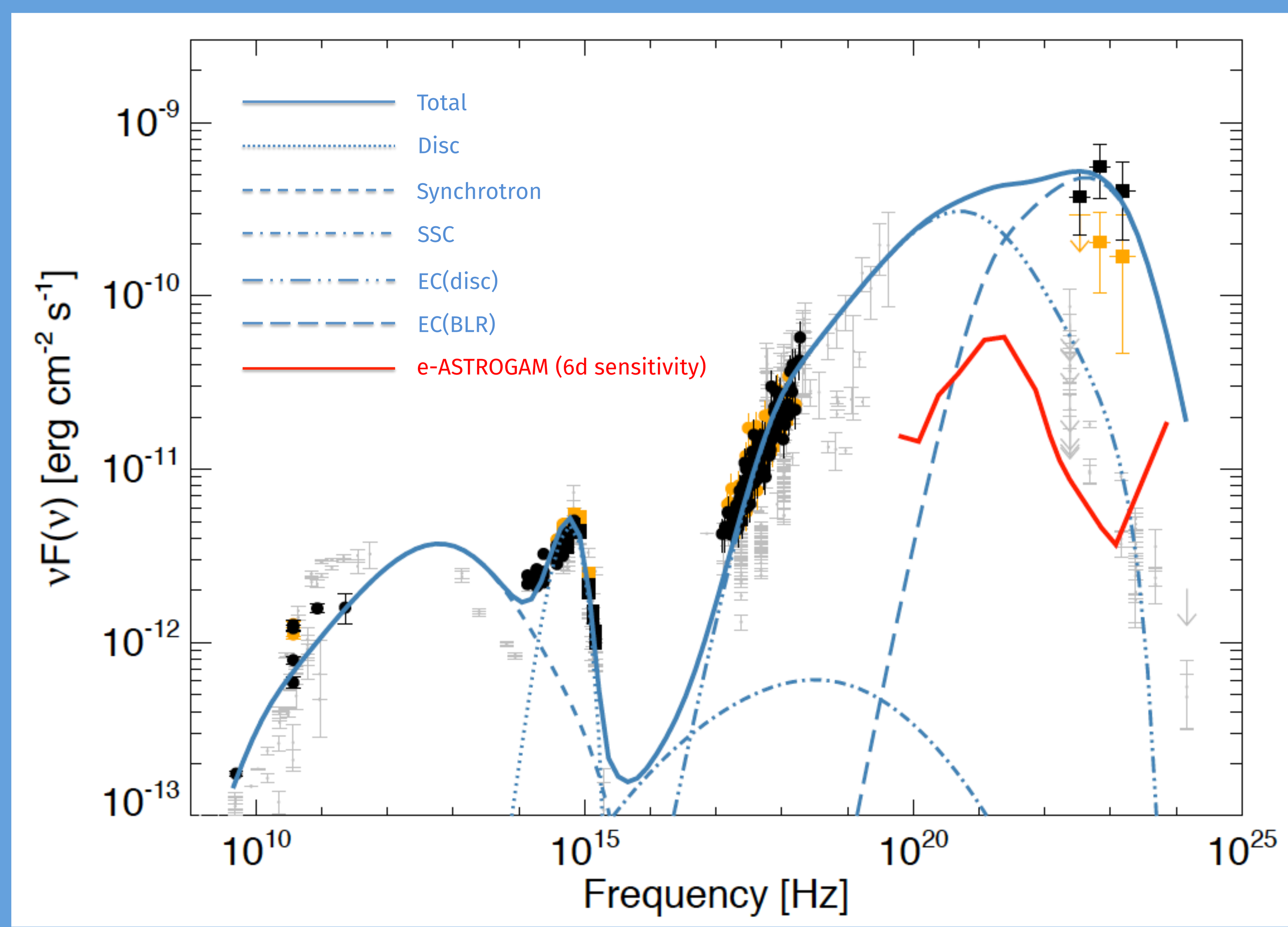


Table 1: Parameters for the second flare (F2) SED model.

Description	Parameter	Value	Unit
Pre-break spectral index	$\alpha_{\rm l}$	2.0	
Post-break spectral index	$\alpha_{\rm h}$	4.4	
Minimum e^- Lorentz factor	$\gamma_{\rm min}$	20	
Break e^- Lorentz factor	$\gamma_{\rm b}$	750	
Particle density	K	20	cm^{-3}
Blob radius	$R_{\rm blob}$	5×10^{16}	cm
Broad-line region radius	$R_{\rm BLR}$	6.2×10^{17}	cm
Reprocessed % of the irradiating continuum	$f_{\rm BLR}$	1	%
Blob distance w.r.t. the BH	$z_{\rm jet}$	7×10^{16}	cm
Magnetic field	B	0.8	G
Bulk Lorentz factor	Γ	15	
Angle w.r.t. the l.o.s.	Θ_0	2	degrees
Doppler factor	δ	23.6	
Disc luminosity	$L_{\rm d}$	2×10^{47}	erg s^{-1}
Disc temperature	$T_{\rm d}$	4×10^{4}	$^\circ K$

In order to model the SED, we took into account a one-zone leptonic model. The emission along the jet is assumed to be produced in a spherical blob with co-moving radius R_{blob} by accelerated electrons characterized by a broken power-law energy density distribution:

$$n_e(\gamma) = \frac{K\gamma_{\rm b}^{-1}}{(\gamma/\gamma_{\rm b})^{\alpha_{\rm l}} + (\gamma/\gamma_{\rm b})^{\alpha_{\rm h}}}$$

The above table summarizes the parameters for the second flare (**F2**) SED model.

Discussion

The SED fit of the second gamma-ray flare (F2) suggest a distance of the emission zone from the central black-hole of about 7×10^{16} cm and a total jet power of about 6×10^{46} erg s^{-1}.
We conclude that during the most prominent gamma-ray flaring period the dissipation region is within the broad-line region. Moreover, this class of high-redshift, large-mass black-hole flat-spectrum radio quasars might be good targets for planned γ-ray satellite such as e-ASTROGAM.