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Target of Opportunity observations of flaring blazars with H.E.S.S.

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Blazars are the most common class of TeV extragalactic emitters. In the framework of the AGN unified model, they are understood as AGNs with a relativistic jet pointing close the line of sight. They are characterized by extreme variability, observed to be as fast as minutes. These flares are usually observed at multiple wavelengths and their study require fast reaction and coordination among multiwavelength observatories. An important part of blazars observations with the H.E.S.S. array of Cherenkov telescopes is thus in the form of Target of Opportunity (ToO) observations. In this contribution the H.E.S.S. blazar ToO program is presented, with a focus on recent results.

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1. The H.E.S.S. Blazar Target of Opportunity Program

The summary of H.E.S.S. Target of Opportunity observations of blazars from 2016 to Spring 2023 is provided in Table 1. Columns are: observing season, observing period (defined by full Moons), the observed target, its blazar sub-class, its redshift, the exposure in hours, the type of trigger, if the observations resulted in detection by H.E.S.S., and references.

Table 1. Summary table of the H.E.S.S. blazar ToO program from 2016.

Observing Season	Observing Period	Source	Blazar Type	Redshift	Exposure [h]	Trigger	Detection	Ref.
2016	P2016-03	PKS 2022-077	FSRQ	1.388	1.6	LAT	✗	[2]
	P2016-05	PKS 1510-089	FSRQ	0.36	16.2	VHE	✓	[4]
	P2016-07	OT 081	LBL	0.32	14.6	LAT	✓	[5]
	P2016-08	CTA 102	FSRQ	1.032	13.0	Optical	✗	[7]
	P2016-09	PKS 0447-439	HBL	0.343	6.5	VHE	✓	[7]
	P2016-10	PKS 2247-131	?BL	0.22?	6.8	LAT	✗	
	P2016-11	PKS 0507+17	FSRQ	0.44	0.8	LAT	✗	
	P2016-12	Mrk 421	HBL	0.03	2.5	VHE	✓	
	P2017-01	OJ 287	?BL	0.306	2.0	X-rays	✗	
	P2017-02	3C 279	FSRQ	0.536	5.1	Optical	✗	[1]
2017	P2017-03	3C 279	FSRQ	0.536	4.1	Optical	✗	[1]
	P2017-06	3C 279	FSRQ	0.536	0.5	LAT	✗	[1]
	P2017-09/10	PKS 2022-077	FSRQ	1.388	10.5	LAT	✗	[2]
	P2017-12	Mrk 421	HBL	0.03	1.5	VHE	✓	
	P2018-01	3C 279	FSRQ	0.536	8.0	LAT	✓	[1]
2018	P2018-02	3C 279	FSRQ	0.536	4.3	LAT	✗	[1]
	P2018-03	TXS 0506+056	IBL	0.337	3.8	LAT	✗	
	P2018-04	PKS 0903-57	FSRQ	0.695	1.0	LAT	✗	
	P2018-04	M 87	RG	0.004	14.7	VHE	✓	
	P2018-06	3C 279	FSRQ	0.536	23.0	LAT	✓	[1]
	P2018-07	AP Lib	LBL	0.049	7.0	LAT	✓	
	P2018-09	PKS 0346-27	FSRQ	0.99	2.8	LAT	✗	[1]
	P2018-11	PKS 0625-354	HBL?	0.055	23.0	VHE	✓	[3]
	P2018-13	1ES 1218+304	HBL	0.182	11.5	VHE	✗	
2019	P2019-03/04	PG 1553+113	HBL	$\simeq 0.4$	13.5	Optical	✓	
	P2019-07	PKS 0346-27	FSRQ	0.99	5.3	LAT	✗	
	P2019-12	PKS 0208-512	FSRQ	1.003	8.5	LAT	✗	
	P2020-01	3C 273	FSRQ	0.158	2.5	LAT	✗	
	P2020-02	PKS 1156-221	FSRQ	0.565	1.0	LAT	✗	
2020	P2020-04	PKS 0903-57	HBL	0.695	13.8	LAT	✓	[6]
	P2020-06	PKS 1156-221	FSRQ	0.565	8.5	LAT	✗	
	P2020-10	BL Lac	IBL	0.069	9.8	LAT	✗	
	P2020-12	PKS 0513-459	FSRQ	0.194	10.0	LAT	✗	

Table 1 (cont'd)

Observing Season	Observing Period	Source	Blazar Type	Redshift	Exposure [h]	Trigger	Detection	Ref.
2021	P2021-02	PKS 1127-145	FSRQ	1.19	9.8	LAT	✗	
	P2021-03	PKS 0837+012	FSRQ	1.12	10.0	LAT	✗	
	P2021-05	GB6 J1058+2817	?BL	0.82	1.5	LAT	✗	
	P2021-05	PKS 0027-426	FSRQ	0.492	1.3	LAT	✗	
	P2021-06	PKS 1454-354	FSRQ	1.424	10.5	LAT	✗	
	P2021-06	PKS 1313-333	FSRQ	1.21	9.7	LAT	✗	
	P2021-07	PKS 1334-127	FSRQ	0.54	9.7	LAT	✗	
	P2021-07/08	BL Lac	IBL	0.069	1.7	LAT	✗	
	P2021-09/10	PKS 0301-721	FSRQ	0.823	9.2	LAT	✗	
	P21-11->22-01	PKS 0346-27	FSRQ	0.99	31.5	LAT	✓	[8]
	P2021-13	PKS 0903-57	FSRQ	0.695	1.0	LAT	✗	
2022	P2022-04/05	PKS 1954-388	FSRQ	0.63	36.4	LAT	✗	
	P2022-05	PKS 1127-145	FSRQ	1.19	1.9	LAT	✗	
	P2022-06	PKS 0035-252	FSRQ	0.498	1.5	LAT	✗	
	P2022-07	PMN J1717-5155	FSRQ	1.16	7.5	LAT	✗	
	P2022-07/08	PKS 1424-418	FSRQ	1.52	31.7	LAT	✗	
	P2022-12	3FHL J0543.9-5532	FSRQ	0.273	27.5	VHE	✓	
2023	P2023-02	PKS 0402-362	FSRQ	1.42	9.9	LAT	✗	
	P2023-05	PKS 1424-418	FSRQ	1.52	3.5	LAT	✗	

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