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<td><strong>Title</strong></td>
<td>GTC Optical Spectroscopy of TeV Blazars</td>
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<tr>
<td><strong>Authors</strong></td>
<td>PAIANO, Simona; Falomo, R.; Treves, A.; LANDONI, Marco; Scarpa, R.; et al.</td>
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GTC optical spectroscopy of TeV blazars

Speaker: S. Paiano - (INAF-OAPD)
Collaborators: R. Falomo, A. Treves, M. Landoni, R. Scarpa, C. Righi

AGN12 meeting - Napoli - 29 Settembre 2016
Aim of the work

Blazars represent the most abundant extragalactic population at GeV–TeV energies

Contrary to most AGNs with prominent emission features, Blazars/BL Lacs often lack its redshift (or it is very uncertain) [see Landoni’s talk]
Aim of the work

Blazars represent the most abundant extragalactic population at GeV–TeV energies

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For the interpretation of emission models

To study the EBL
Aim of the work

Blazars represent the most abundant extragalactic population at GeV–TeV energies

Contrary to most AGNs with prominent emission features, Blazars/BL Lacs often lack its redshift (or it is very uncertain) [see Landoni’s talk]

For the interpretation of emission models

To study the EBL

Ghisellini+2011
Aim of the work

Blazars represent the most abundant extragalactic population at GeV–TeV energies

Contrary to most AGNs with prominent emission features, Blazars/BL Lacs often lack its redshift (or it is very uncertain)

[see Landoni’s talk]

For the interpretation of emission models

To study the EBL

Ahnen+2016 (MAGIC coll.)

Franceschini+2016
Aim of the work

Blazars represent the most abundant extragalactic population at GeV-TeV energies. Contrary to most AGNs with prominent emission features, Blazars/BL Lacs often lack its redshift (or it is very uncertain).

To study the EBL for the interpretation of emission models.

We present the results of a spectroscopical campaign carried out at the GTC for a sample of 21 TeV (or candidate TeV) blazars with unknown/uncertain redshift.
The Sample

14 TeV blazars and 7 TeV candidates of BZCAT with unknown or uncertain redshift

BZB J1120+4212 (RBS0970) $\rightarrow$ $z=0.124$ (?)
The Sample

14 TeV blazars and 7 TeV candidates of BZCAT with unknown or uncertain redshift

S3 1227+255

Z=0.135 (?)

So far no spectrum published

Massaro+2015
The Sample

14 TeV blazars and 7 TeV candidates of BZCAT with unknown or uncertain redshift

S2 0109+22  $z = 0.26$

SDSS spectrum, Healey+2008, Shaw+2012
The Sample

14 TeV blazars and 7 TeV candidates of BZCAT with unknown or uncertain redshift

S2 0109+22 $z=0.26$

SDSS spectrum, Healey+2008, Shaw+2012
The Sample

14 TeV blazars and 7 TeV candidates of B2CAT with unknown or uncertain redshift

S2 0109+22 z=0.26 = still unknown

Paiano+2016
GTC observations

Spectra (4000–10000 A) obtained with OSIRIS@GTC
Details in Landoni’s talk

Spectra with high SNR $\rightarrow \sim 100$–500
Results: search for em/abs features

New Redshift for PKS 1424+240
Results: search for em/abs features

New Redshift for PKS 1424+240

\[[\text{OII}] 3727 \; \text{A} ; \; [\text{OIII}] 5007 \; \text{A}\]

@z = 0.604
Results: search for em/abs features

MgII abs lines for BZB1243 & BZB1540

BZBJ1243+3627
MgII 2800A @ z > 0.48

BZBJ1540+8155
MgII 2800A @ z > 0.67
Results: search for em/abs features

4 targets with confirmed redshift
6 targets with no-confirmed redshift and still unknown

3C 66A → z=0.444(?)

Miller+78 (MgII ?), Spectrum above from Lanzetta+1993
**Results:** search for em/abs features

4 targets with confirmed redshift
6 targets with no-confirmed redshift and still unknown

3C 66A $\rightarrow z=0.444(?) \rightarrow$ not confirmed

Miller+78 (MgII ?), Spectrum above from Lanzetta+1993

SNR=300 - $\text{Ewmin}=0.1 \, \text{A} \rightarrow z>0.1$
Results: search for em/abs features

4 targets with confirmed redshift
6 targets with no-confirmed redshift and still unknown

S3 1227+255 → z=0.135(?) → not confirmed

Nass+96 → No spectrum
   No info

SNR=300 - Ewmin=0.09 Å - z>0.1
Results: Lower Limits on the redshift

Non-thermal Nucleus + Elliptical host galaxy = Spectrum observed!

Mag = 17, z = 0.10, Diluted EW = 1.60 Å
Results: Lower Limits on the redshift

Non-thermal Nucleus + Elliptical host galaxy = Spectrum observed!

Mag = 17  z = 0.25  Diluted EW = 0.49 A
Results: Lower Limits on the redshift

Non-thermal Nucleus + Elliptical host galaxy = Spectrum observed!

Mag=17  z=0.50  Diluted EW=0.15 A
Results: Lower Limits on the redshift

Non-thermal Nucleus + Elliptical host galaxy = Spectrum observed!

With wide range and high SNR spectra, we can derive EW upper limits and Redshift lower limits

We derive redshift lower limits (>0.1 - 0.90) for all of our targets with unknown redshift
Towards the Future

For our sample we have new redshift, but for many targets the previous values are not confirmed:

Several TeV blazars have still unknown redshift

Waiting for the EELT (39m) equipped with a Xshooter-like (@VLT) instrument

\[ T_{\text{exp}} = 3600 \text{ sec} \]
\[ N_{\text{uc/Host}} = 2500 \]