Observation of gamma-ray emission from the Markarian 421 with the LHAASO-WCDA

Ran Wang, Min Zha, Cunfeng Feng

Shandong University, Qingdao, China

Key Laboratory of Particle Astrop.hysics, Institute of High Energy Physics, CAS, Beijing, China

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Introduction

Why to study gamma-ray source?

- ✓ The observations of very high energy gamma astronomy based on the WCDA will contribute to the observation of the cosmic ray energy spectrum, the limiting model of active galactic nuclei, and the understanding of extreme celestial activity.

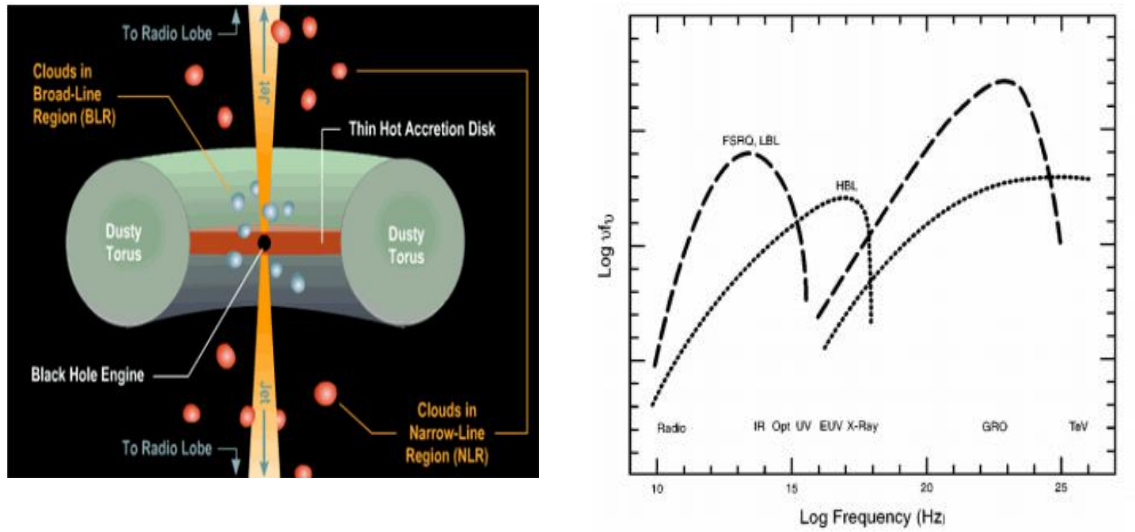


Fig. 1: Left:The model structure of Active Galactic Nuclei. Right: Broad-band energy spectrum from radio to TEV gamma-ray

The gamma/proton sepration

Given that most of the events detected by WCDA are induced by cosmic rays, so maximize the sensitivity to gamma-rays showers through the background suppression is important.

$$compactness = \frac{N_{hit}}{Max(Q_i; r > R_c)}$$

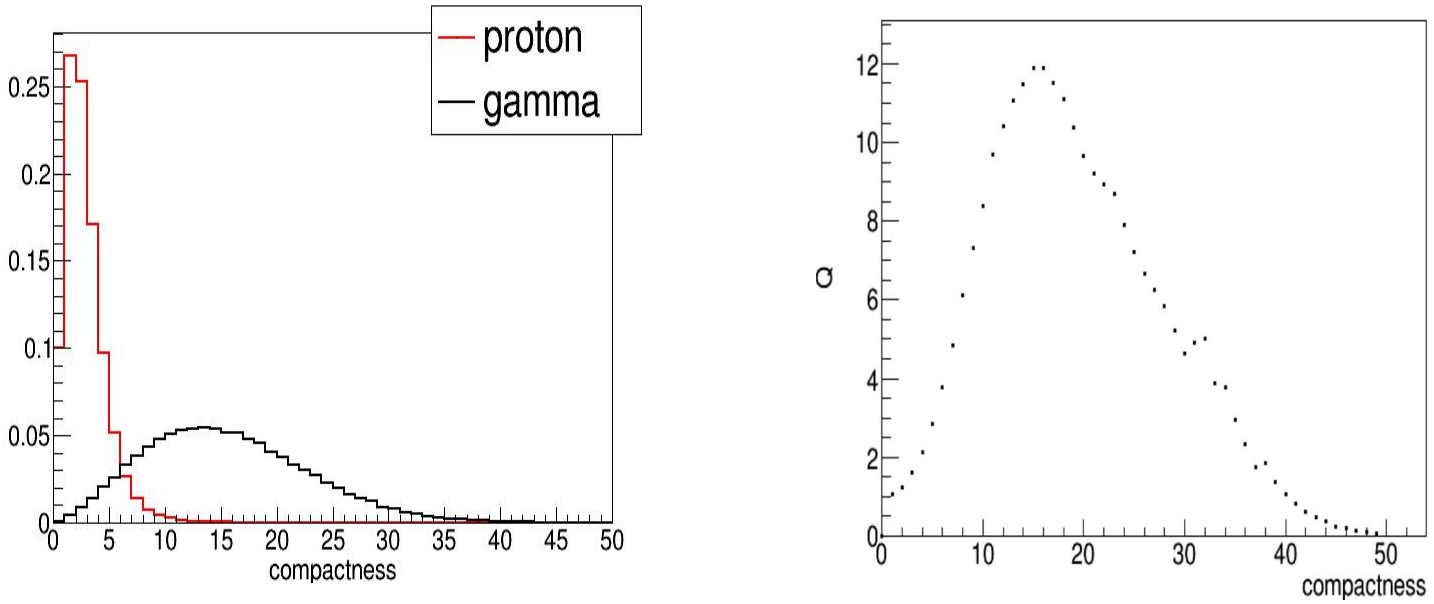
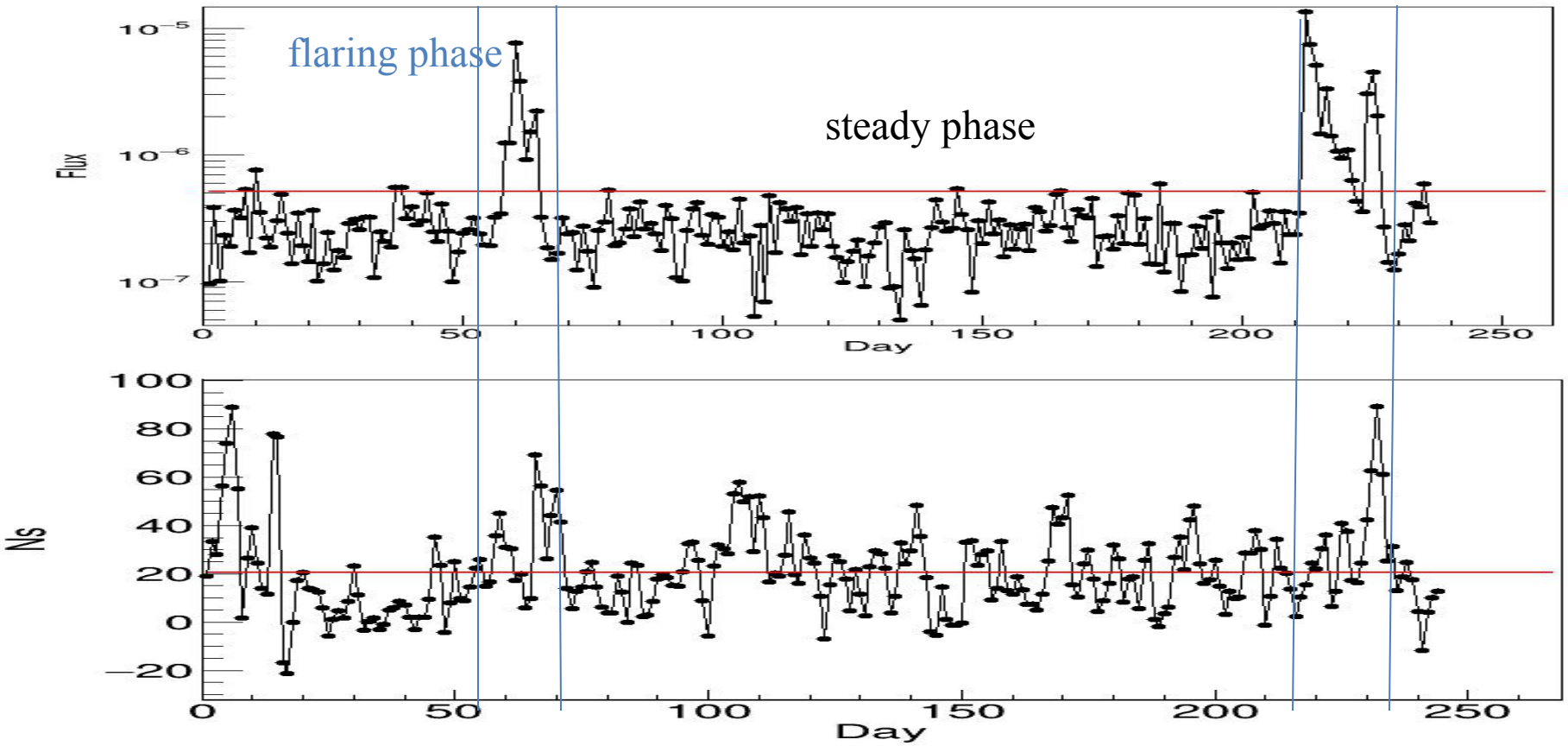


Figure 3: (Left)The compactness distribution of proton and gamma. (Right) The distribution of Q factor.

The flux light curve



Fermi-LAT
Energy range : 100KeV-300GeV

WCDA
Energy range : TeV range

The time correlation among the flux variation in different wavebands was analyzed. The variation of GeV gamma-ray is roughly correlated with the TeV gamma-ray.

The results for Mrk421

steady phase:

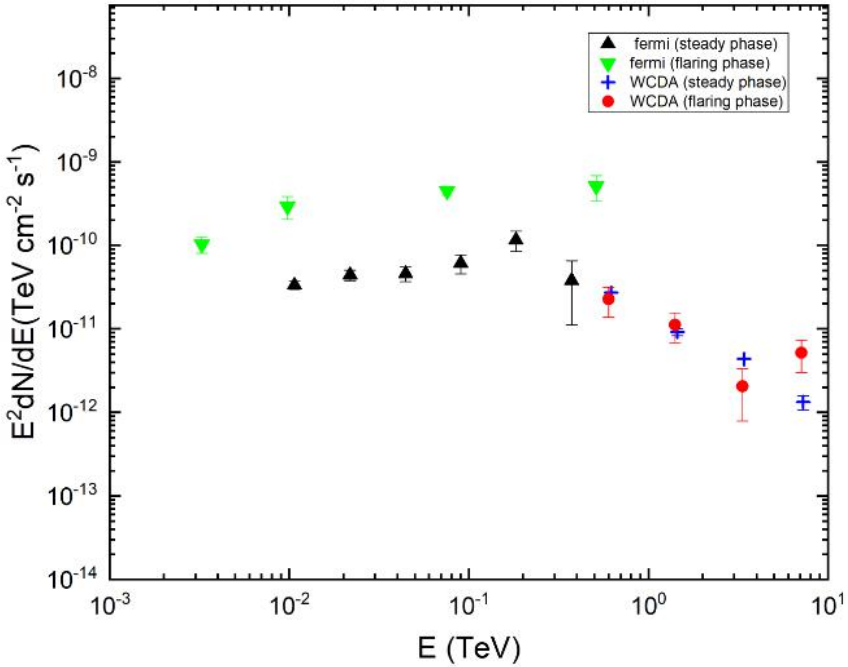
N_{fitc}	$E_{med}(TeV)$	$Excess$	sig
60-100	0.62	1382.62	9.9
100-200	1.45	821.50	16.3
200-300	3.41	214.11	11.7
300-800	7.27	57.17	7.4

flaring phase:

N_{fitc}	$E_{med}(TeV)$	$Excess$	sig
60-100	0.60	122.45	4.2
100-200	1.41	98.90	5.8
200-300	3.34	9.70	3.1
300-800	7.11	20.84	6.9

The significance, number of events exceeding the background in each bin of two different states are listed.

The SEDs of Mrk421



phase	$\phi_0(TeV^{-1}cm^{-1}s^{-1})$	α
Steady phase	4.80± 0.37	3.13± 0.092
Flaring phase	4.13± 1.13	3.18± 0.28

It is found that there is no distinct difference in the energy spectrum index between the two periods.

Summary and Outlook

(Ⅰ) The time correlation among the flux variation in different wavebands was analyzed. The variation of GeV gamma-ray is roughly correlated with the TeV gamma-ray.

(Ⅱ) It is found that there is no distinct difference in the energy spectrum index between the two periods. The energy index in the steady phase is -3.13 and in the flaring phase is -3.18.

(Ⅲ)Use the full array of data and increase the data sample ,and divide the flaring period more carefully according to different flux variation to complete the measurement of Mrk421 energy spectrum distribution.

THANK YOU