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Continuation of an Optical Spectroscopic Campaign of Fermi Blazar Candidates with TNG: Discovery of a New Changing-Look Blazar

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Abstract

Context. Blazars are a distinct subclass of active galactic nuclei (AGN), known for their fast variability, high polarization, and intense emission across the electromagnetic spectrum, from radio waves to gamma rays. Gamma-ray blazar candidates of uncertain type (BCU) are an ongoing challenge in gamma-ray astronomy due to difficulties in classification and redshift determination. Aims. This study continues an optical spectroscopic campaign aimed at identifying the characteristics of BCUs to improve classification and redshift estimates, particularly focusing on low-synchrotron-peak sources. Methods. We conducted a detailed analysis of optical spectroscopic data for a sample of 21 low-synchrotron-peak BCUs plus one bl lac with contradictory results in the literature, using the 3.58-m Telescopio Nazionale Galileo (TNG, La Palma, Spain). Results. Our analysis identifies 14 out of the 21 BCUs as flat-spectrum radio quasars (FSRQs), demonstrating the effectiveness of our selection criteria. Notably, four FSRQs have redshifts exceeding 1, including 4FGL J2000.0+4214 at z = 2.04. Six sources are classified as bl lacs, with one of them, 4FGL J0746.5-0719, showing a featureless spectrum in this work despite previously exhibiting strong lines, suggesting it may be a changing-look blazar. One source remains classified as a BCU due to a noisy spectrum. Additionally, we observed a bl lac object, 4FGL J1054.5+2211, due to inconsistent redshift estimates in the literature, but we could not confirm any redshift due to its featureless spectrum. Our findings provide insights into the classification and redshift estimation of blazar candidates, emphasizing the need for continued spectroscopic monitoring.

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