Fermi Study of Gamma-ray Millisecond Pulsars: the Spectral Shape and Pulsed Emission from J0614-3329 up to 60 GeV

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We report our analysis of the Fermi Large Area Telescope data for 39 millisecond pulsars (MSPs) listed in the second gamma-ray pulsar catalog. Spectra of the pulsars are obtained. We fit the spectra with a function of a power law with exponential cutoff, and find the best-fit parameters of photon index and cutoff energy. This spectral shape, which includes the intrinsic differences in the spectra of the MSPs, can be used for finding candidate MSPs and unidentified types of sources detected by Fermi at high Galactic latitudes. In one of the MSPs PSR J0614-3329, we find significant pulsed emission up to 200 GeV. The result has thus added this MSP to the group of the Crab and Vela pulsars that have been detected with >50 GeV pulsed emission. Comparing the gamma-ray spectrum of PSR J0614-3329 with those of the Crab and Vela pulsars, we discuss possible emission mechanisms for the very high-energy component.