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A study of the very-high-energy emission of the Crab pulsar with the LST-1

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Three pulsars, namely Crab, Vela and Geminga, have been detected in gamma rays above 20 GeV using Imaging Cherenkov Atmospheric Telescopes (IACT). Detecting new very-high-energy (VHE) pulsars is challenging due to the limited sensitivity of the current IACTs. The Cherenkov Telescope Array Observatory (CTAO) will be the next generation of Cherenkov telescopes, comprised of dozens of telescopes of different sizes, that will improve the sensitivity by an order of magnitude compared to previous IACTs. The LST-1 is the first Large-Sized Telescope (LST) of the CTAO under commissioning at the Roque de los Muchachos observatory on the island of La Palma. It is designed to explore the gamma-ray sky down to tens of GeV, making it ideally suited for studying gamma-ray pulsars. In this contribution, we report the results of the analysis of ~100 hours of observations of the Crab pulsar with the LST-1. Each pulsar peak has been detected at a statistical significance >10σ. Energy-dependent phaseograms and pulse widths are studied. Phase-resolved spectra are reconstructed with LST-1 from 20 GeV to 450 GeV for the first peak (P1) and up to 700 GeV for the second one (P2). The bridge spectrum is also significantly detected and is characterized below 100 GeV. Additionally, we have used 14 years of Fermi-LAT data to complement the LST-1 results at lower energies, showing good agreement between both instruments below 30 GeV. These results confirm the potential of LSTs to study and detect new VHE gamma-ray pulsars in the future.

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