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Search for gamma rays above 100 TeV from the Crab Nebula using the Tibet air shower array and the 100 m² muon detector

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The Crab Nebula is the standard calibration candle for TeV cosmic gamma-ray experiments.

None of those experiments has detected gamma rays above 100 TeV from the Crab Nebula, and the best upper limits have been given by the CASA-MIA experiment.

In the circumstances, it is a common understanding that the energy spectrum of the Crab Nebula can be reproduced well by a mechanism based on the synchrotron self-Compton emission of high energy electrons.

The observation of the energy spectrum of the Crab Nebula above 100 TeV with high sensitivity is important, in order to confirm the leptonic origin of the TeV gamma-ray emission from the Crab Nebula.

To improve the sensitivity of the Tibet air shower array to TeV cosmic gamma rays, we are planning to add an underground

10,000 m² muon detector array to the existing Tibet air shower array.

A small prototype muon detector, 100 m² in area, was constructed under the Tibet air shower array in the late fall of 2007.

In this work, we search for continuous gamma-ray emission from the Crab Nebula above 100 TeV, using the data collected from March 2008 to February 2010 by the Tibet air shower array and the 100 m² muon detector.

We find that our MC simulation is in good agreement with the experimental data.

No significant excess is found, and the most stringent upper limit is obtained above 140 TeV.

Collaboration

– not specified –

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