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On the Implications of the Detection of 20 TeV Pulsations from the Vela Pulsar by H.E.S.S.

Contributed Talk //

Pulsars and Pulsar Wind Nebulae (PWNs)

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Session 4 //
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NOTE: subject to change after more comments by H.E.S.S. colleagues.

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C Venter, for the H.E.S.S. Collaboration

While nearly 3 400 radio and 300 high-energy (HE) gamma-ray pulsars are known, to date only four of them have been detected by ground-based Cherenkov telescopes. This includes the Crab pulsar with pulsed emission up to 1.5 TeV, Geminga up to 75 GeV, B1706-44 up to about 70 GeV, as well as the nearby Vela pulsar up to 120 GeV as measured by the mono 26-m telescope of H.E.S.S. More recently, a new spectral component was unveiled by H.E.S.S. for Vela, the brightest pulsar in the radio and GeV domains. The key experimental results by H.E.S.S. include measuring an astonishing and unprecedented maximum pulsed photon energy of 20 TeV, a derived isotropic very-high-energy (VHE) gamma-ray luminosity of 2e30 erg/s, a fitted VHE spectral index of 1.4 vs. the HE index of 5.25 (unambiguously pointing to a new radiation component), phase-alignment of the respective second light curve peaks in the HE and VHE bands, and the disappearance of the first peak with energy above tens of GeV. These vital measurements point to an emission origin near or beyond the light cylinder that forms the natural boundary of the co-rotating pulsar magnetosphere. They are challenging pulsar models and may potentially be used to discriminate between competing model frameworks. In this talk, I will critically assess whether current pulsar model frameworks can provide an understanding of this crucial new detection.

NAME OF COLLABORATION
H.E.S.S.

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