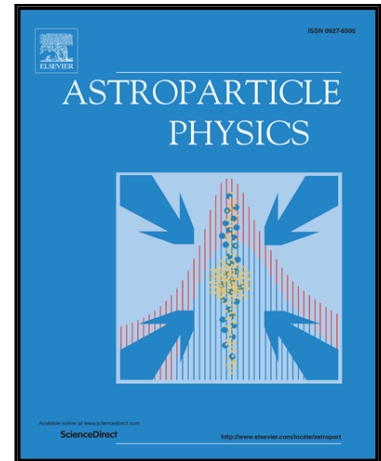


## Accepted Manuscript

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PII: S0927-6505(16)30146-3  
DOI: [10.1016/j.astropartphys.2016.10.003](https://doi.org/10.1016/j.astropartphys.2016.10.003)  
Reference: ASTPHY 2163



To appear in: *Astroparticle Physics*

Received date: 14 September 2016  
Revised date: 1 October 2016  
Accepted date: 17 October 2016

Please cite this article as: Charles H. McGruderIII, Acceleration of particles to high energy via gravitational repulsion in the schwarzschild field, *Astroparticle Physics* (2016), doi: [10.1016/j.astropartphys.2016.10.003](https://doi.org/10.1016/j.astropartphys.2016.10.003)

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# ACCELERATION OF PARTICLES TO HIGH ENERGY VIA GRAVITATIONAL REPULSION IN THE SCHWARZSCHILD FIELD

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*Received:* \_\_\_\_\_; *Accepted:* \_\_\_\_\_

## Abstract

Gravitational repulsion is an inherent aspect of the Schwarzschild solution of the Einstein-Hilbert field equations of general relativity. We show that this circumstance means that it is possible to gravitationally accelerate particles to the highest cosmic ray energies.

Keywords: acceleration of particles, gravitation, cosmic rays

## 1. INTRODUCTION

It is widely believed that there are only two sources of energy available to accelerate cosmic particles to relativistic velocities - magnetic field energy, which accelerates through magnetic connection and kinetic energy, which accelerates through Fermi acceleration (see Drury 2012 for a review). However, the recent discovery of pulsed TeV photons from the Crab pulsar contradicts current models of relativistic cosmic particle formation (Ansoldi et al. 2016). Here we point out that there is a third energy source - gravitational energy, which is capable of accelerating particles to the highest cosmic ray energies observed ( $\sim 10^{20}$  eV).

It is well known that special relativity leads to space, time and mass dependency on velocity. It is however, not so well known, that Einstein's theory of gravitation, general

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