

ICPPA-2022

Investigation of FSR photon suppression in two positron decay mode of dark matter particles by means of MC generators

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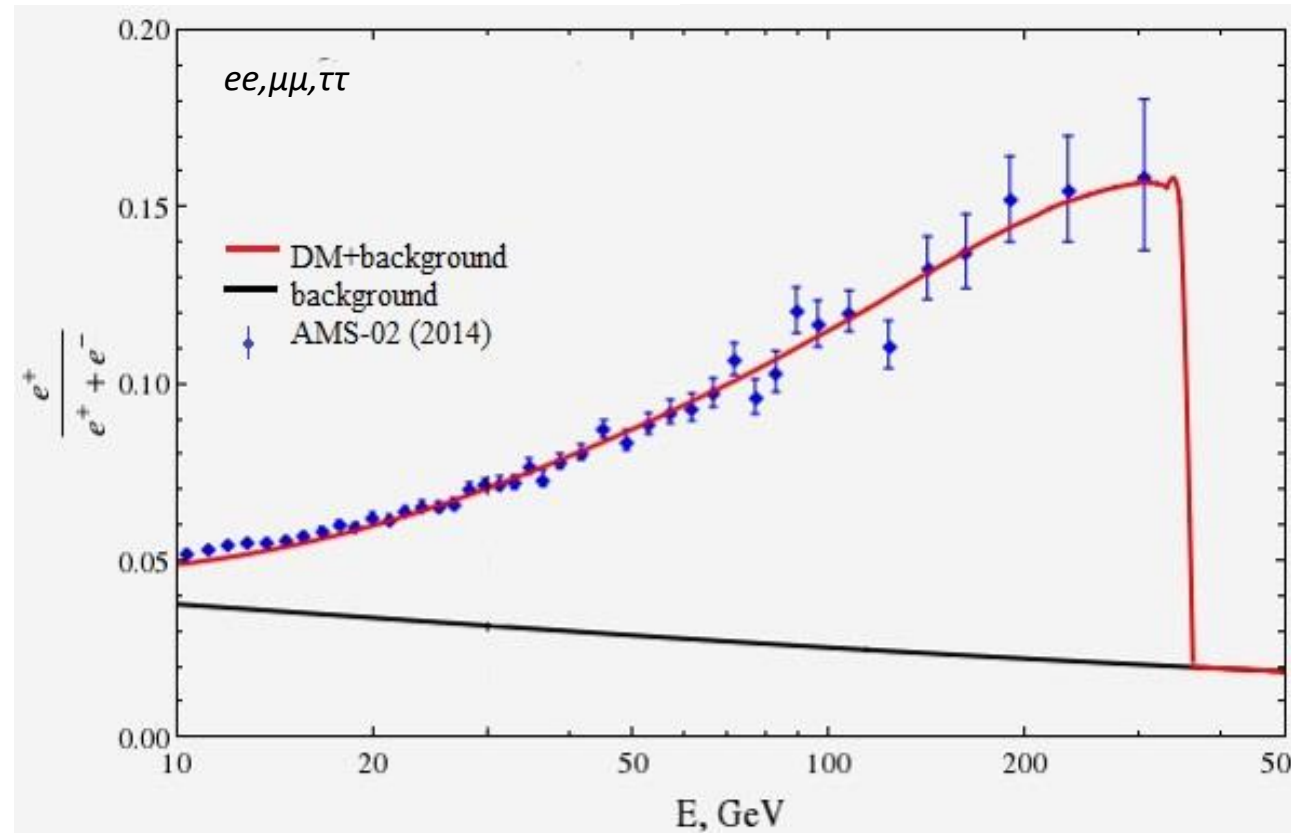
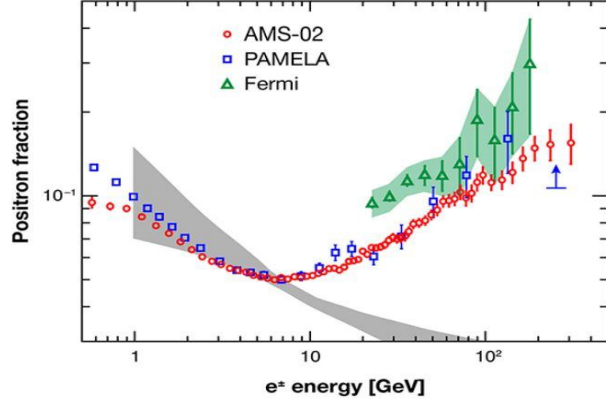
NRNU MEPhI

Moscow, 01/12/2022

Introduction

- Problem of the origin of positron anomaly in cosmic rays (experiments “PAMELA”, “AMS-02”, ...).
- Explanation of this anomaly by means of decay or annihilation of DM particles.
- Contradiction with the results of the experiment (Fermi) on measuring the isotropic cosmic gamma background (IGRB).

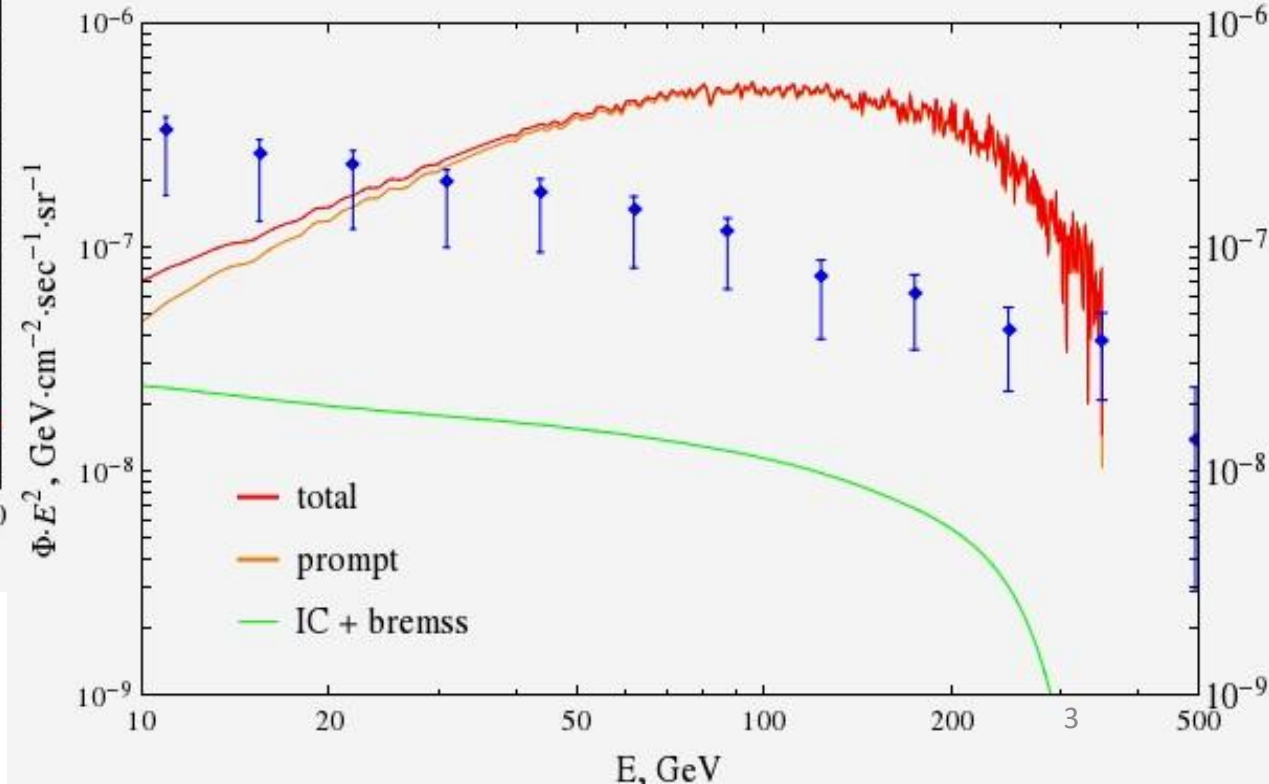
Problem of DM explanation of positron anomaly in cosmic rays



**Contradiction arises
with data on IGRB of
Fermi-LAT**



**In good agreement
with data from
PAMELA and AMS-02**



THE SIMPLEST MODELS FOR THE DECAY OF A DARK MATTER PARTICLE

- In this work the following models of the dark matter particle were investigated:

$$X \rightarrow e^+ + e^- \rightarrow \text{Conventional mode which leads to contradiction with IGRB}$$

$$X \rightarrow e^+ + e^- + \gamma$$

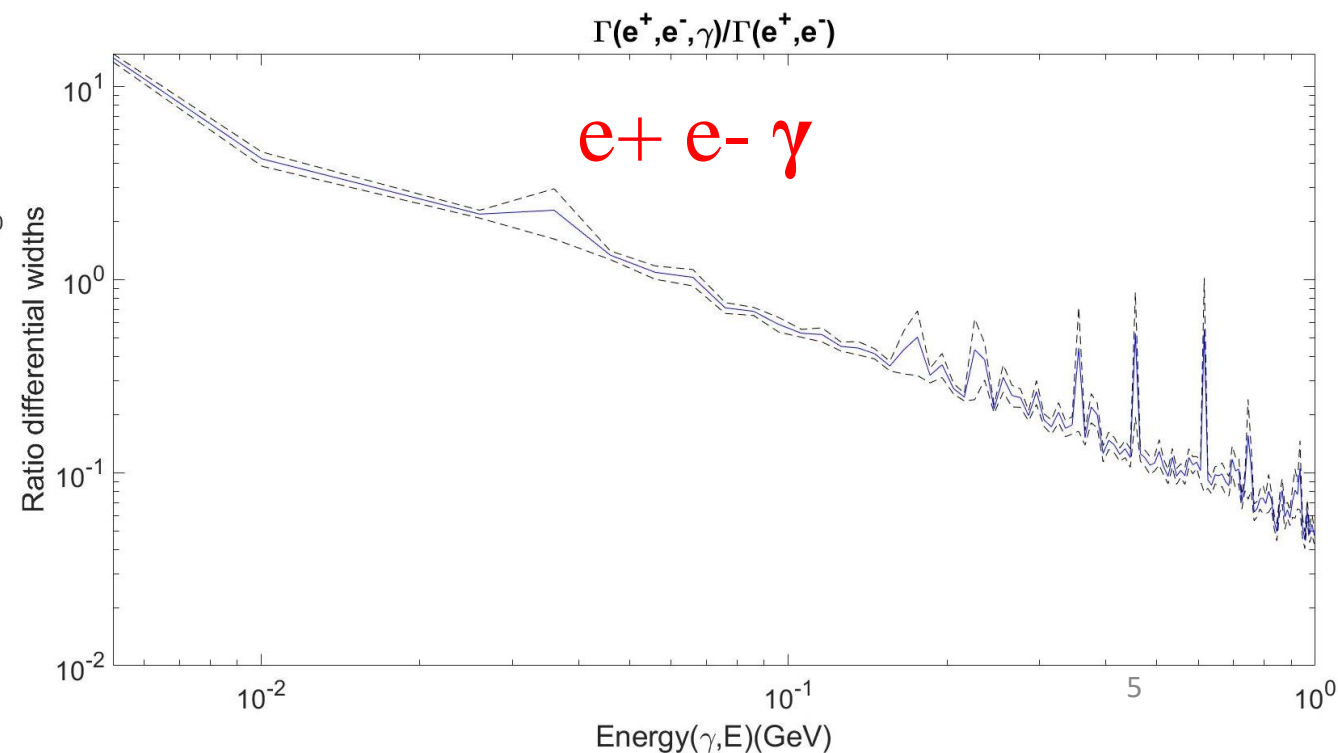
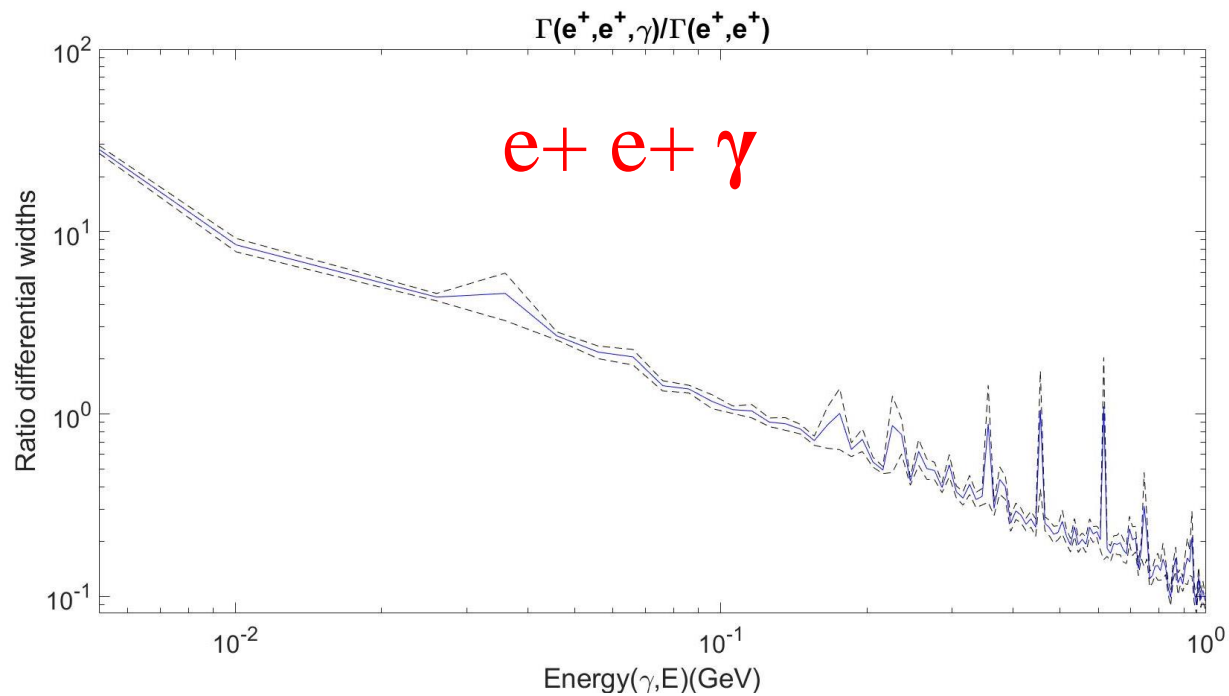
$$X \rightarrow e^+ + e^+ \rightarrow \text{Mode of interest in this work}$$

$$X \rightarrow e^+ + e^+ + \gamma$$

- Minimization of photon yield:

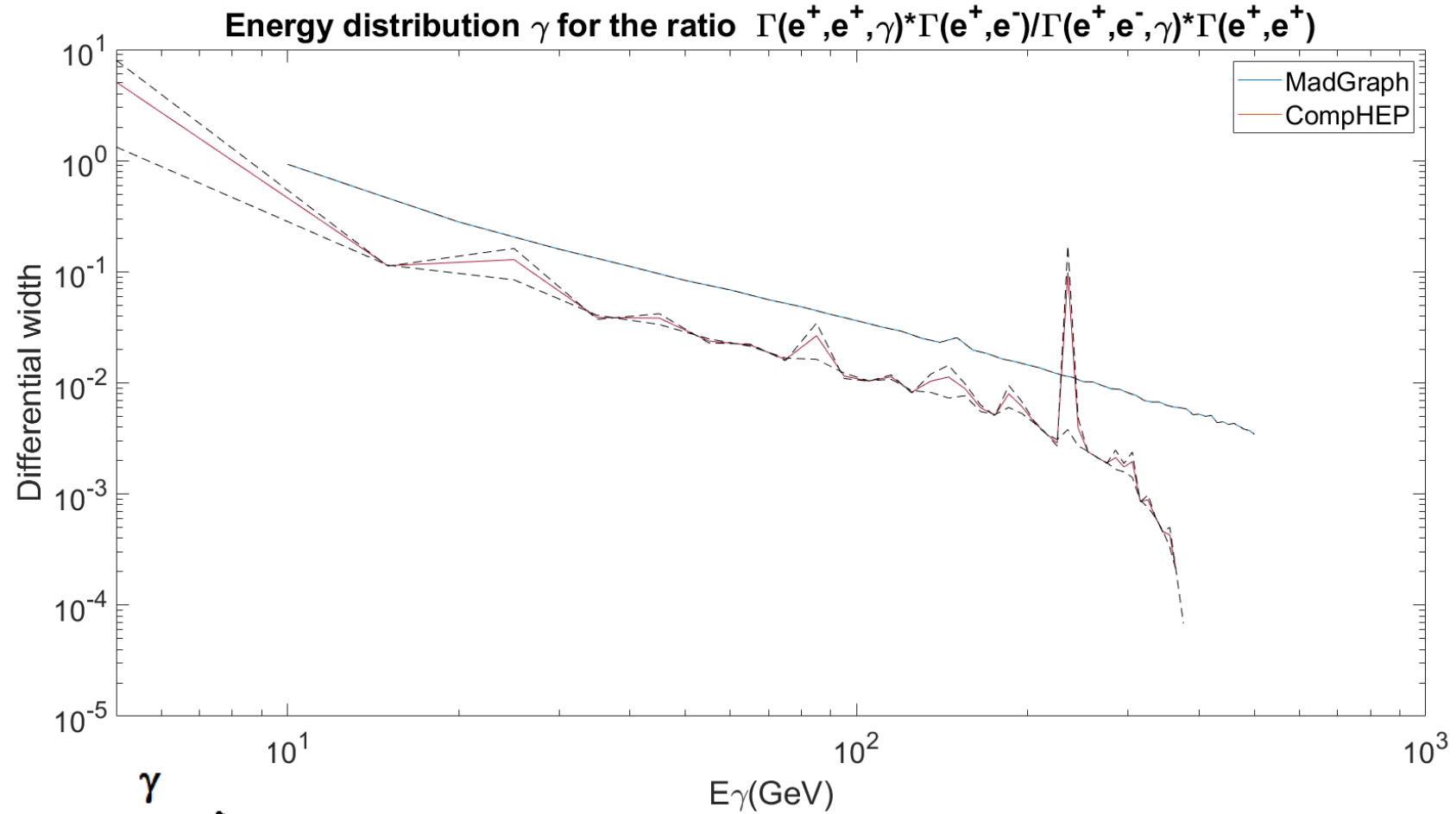
$$\frac{\Gamma(X \rightarrow e^+, e^\pm, \gamma)}{\Gamma(X \rightarrow e^+, e^\pm)} = \min.$$

Photon spectra for the two modes

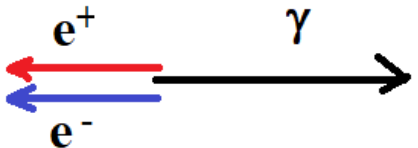
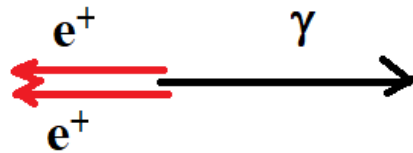


The ratio of two modes

- CompHEP
- MadGraph



Is suppressed due to Pauli exclusion principle



Conclusion

- Several simple models for the decay of a dark matter particle were considered and modeled.
- Simulations were performed using CompHEP and MadGraph MC generators.
- **Near the end of the spectrum, the photon suppression in case of e^+e^+ decay is 100 greater in comparison to e^+e^- decay.**

Thank you for your attention!

Backup

Positron anomaly

