

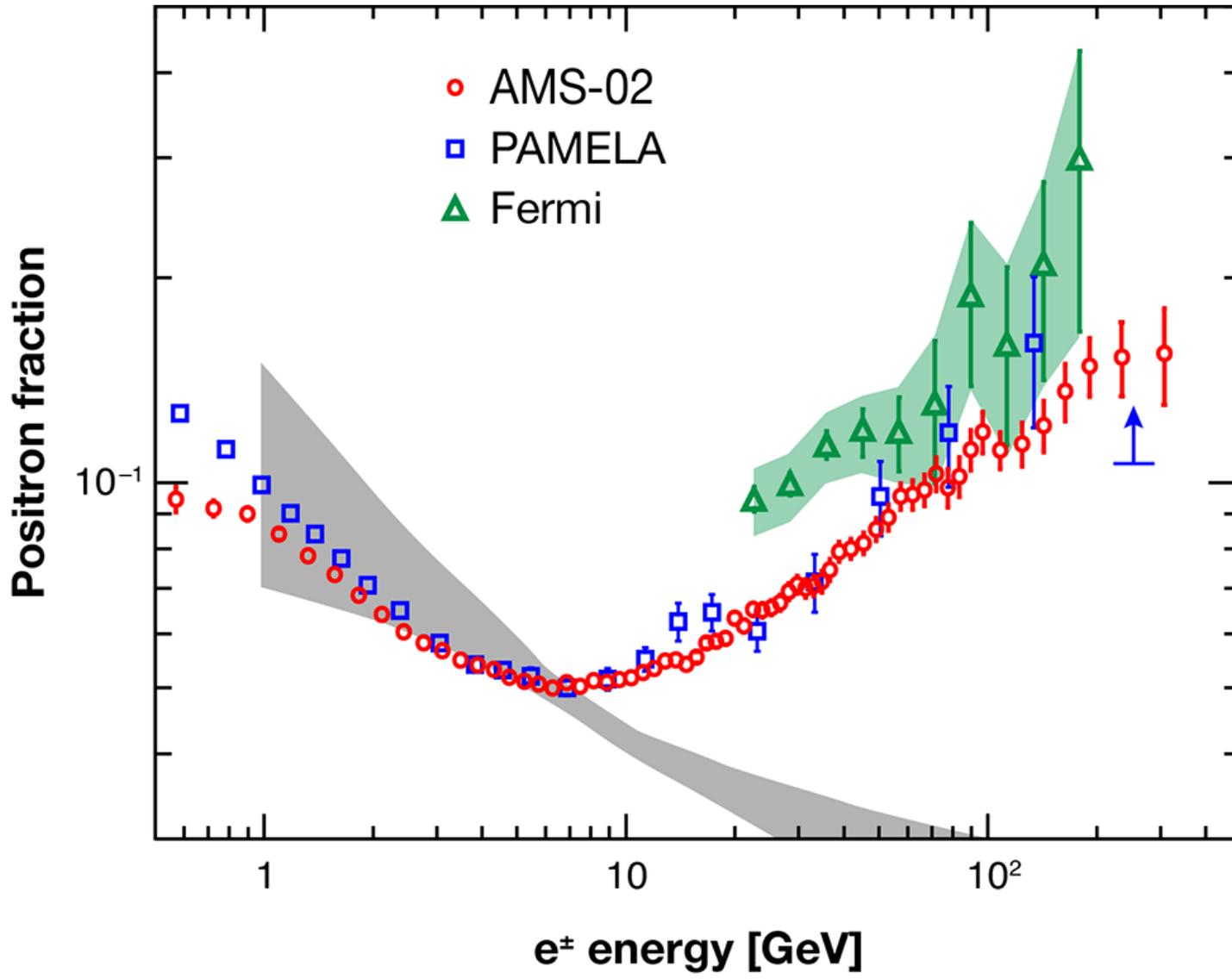
А.М. Гальпер

«Аномальный эффект ПАМЕЛЫ»

ФИАН

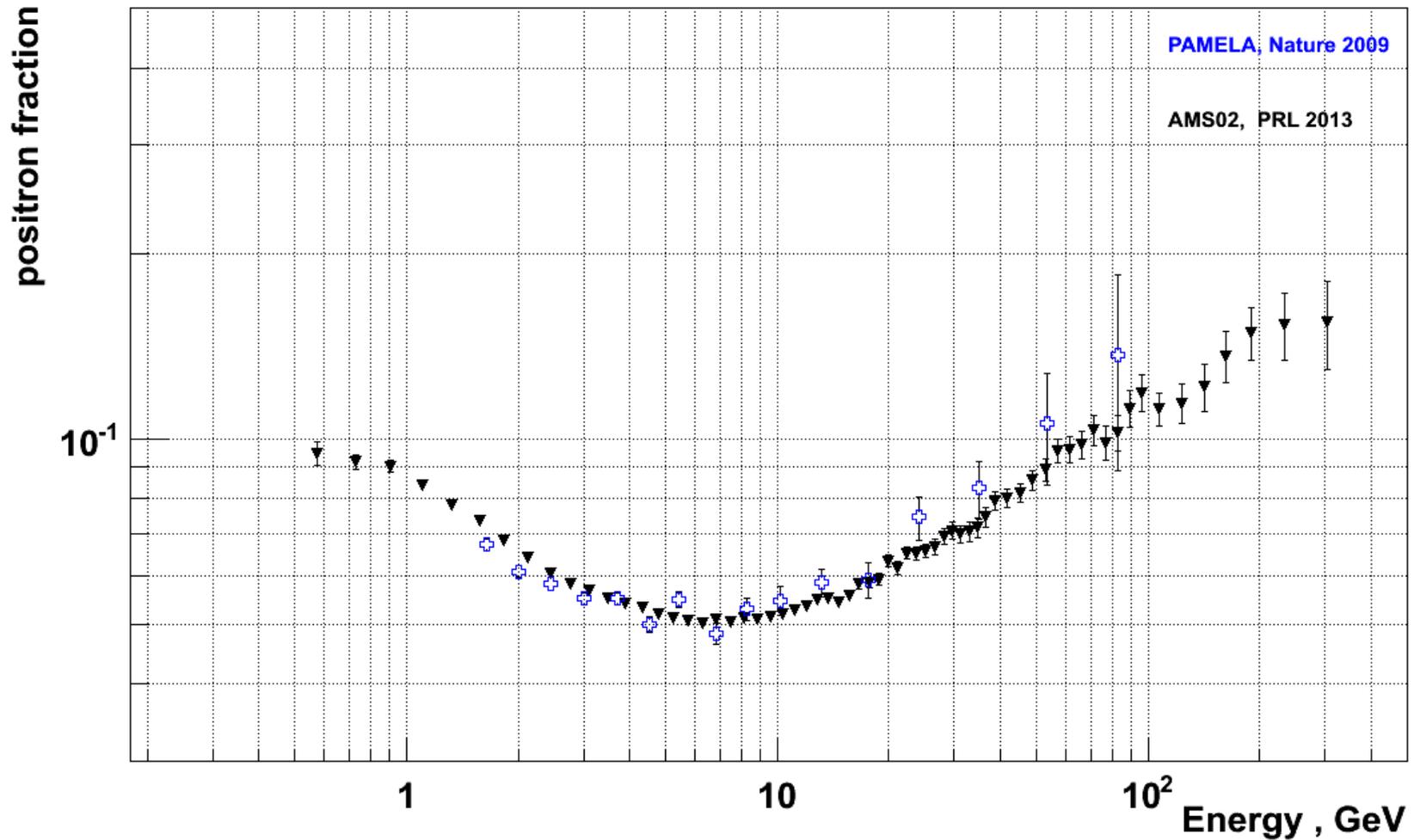
ОЯФА

23 апреля 2013 г.

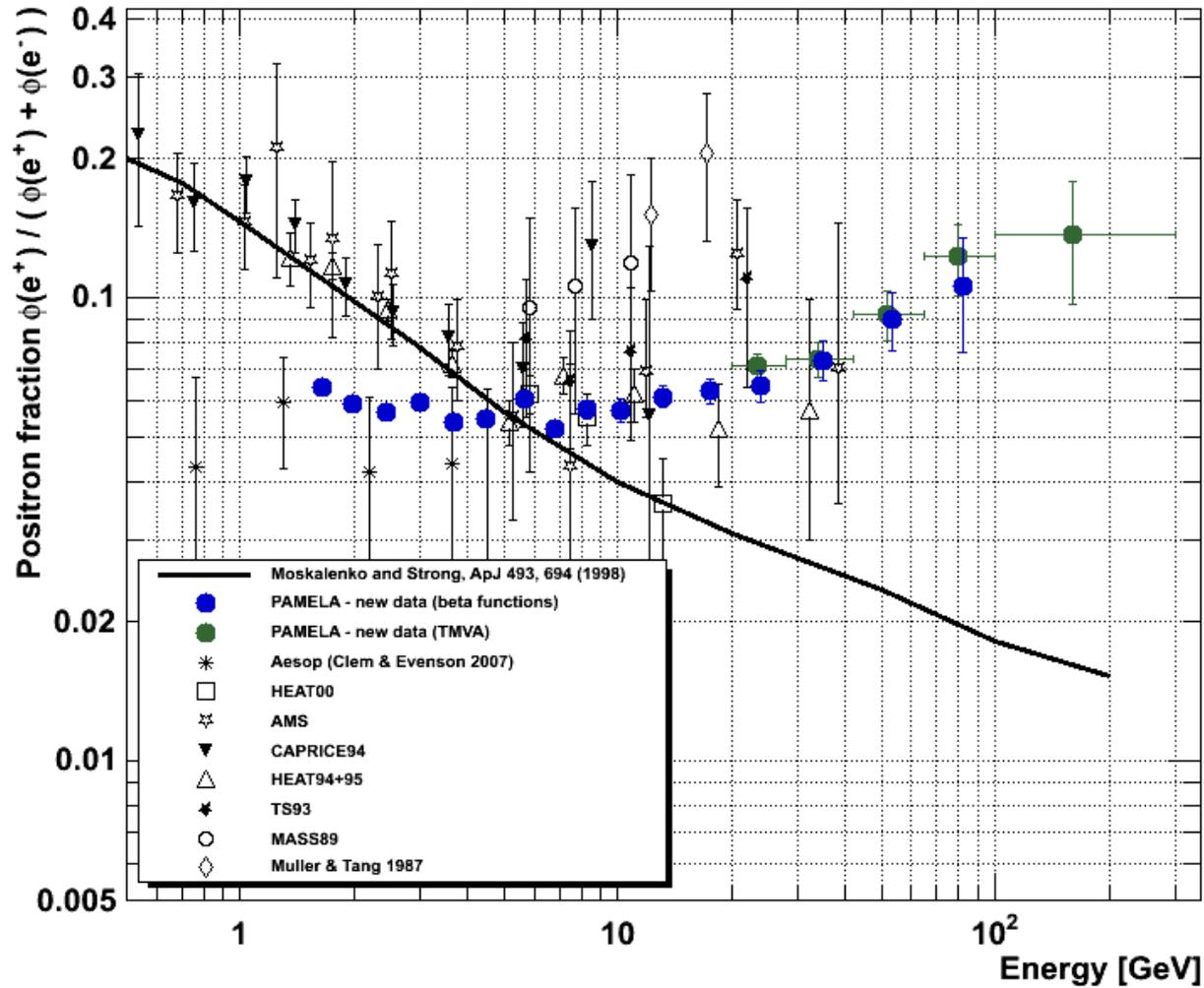


S.Ting, 03.04.2013

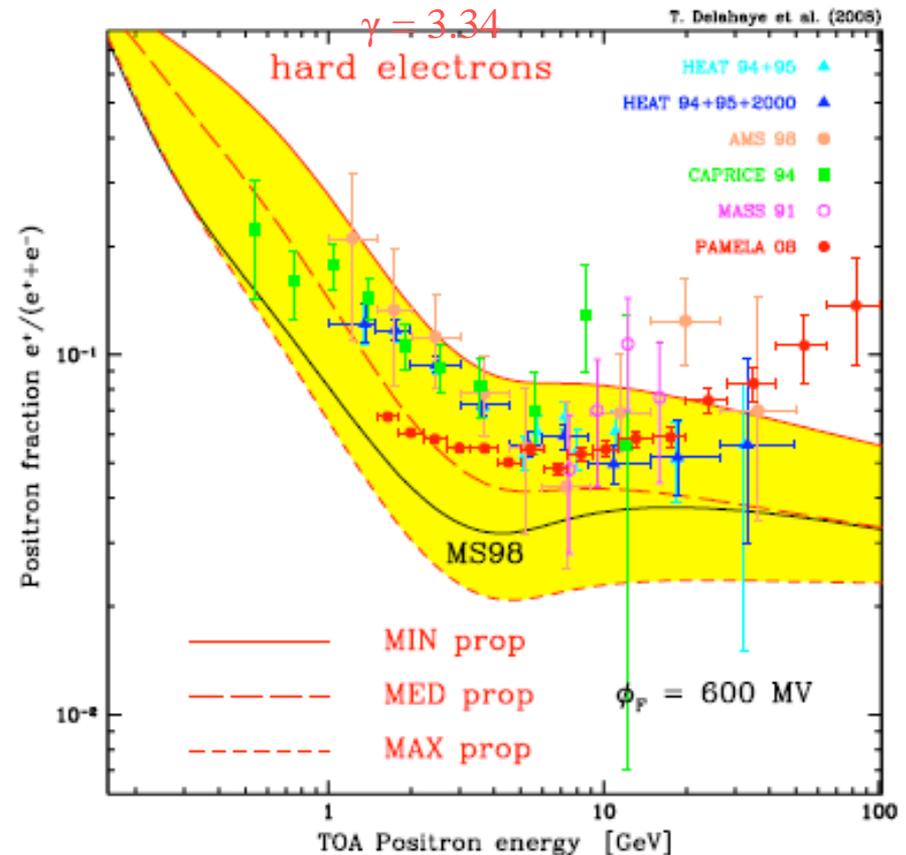
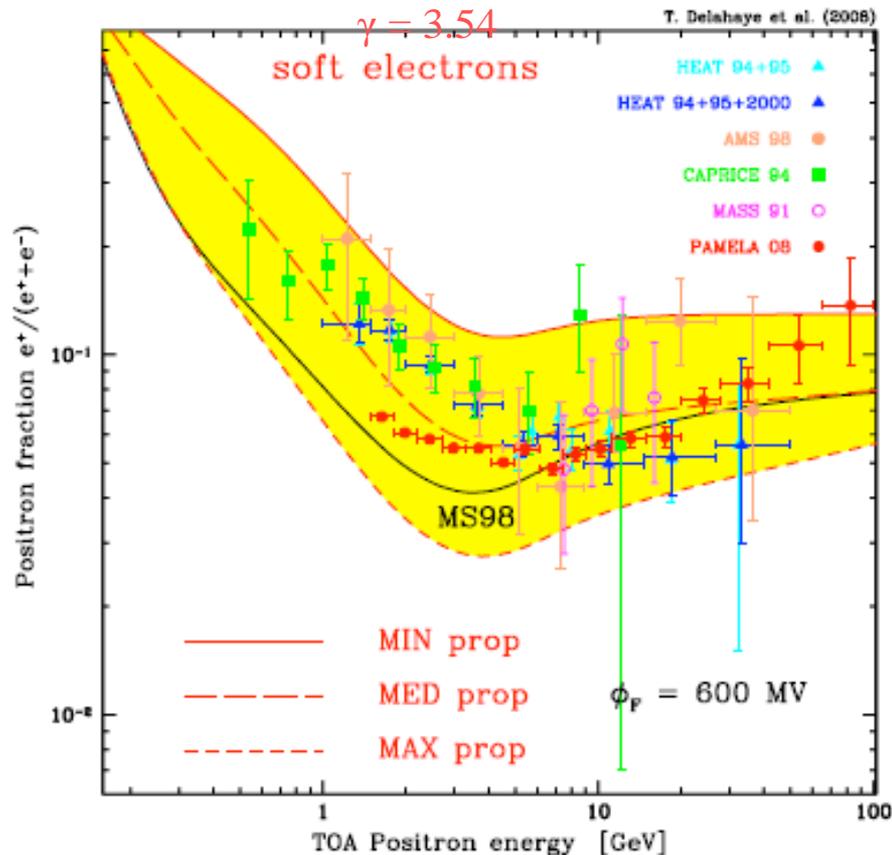
ПАМЕЛА (2008) и AMS02 (2013)



Positron Fraction

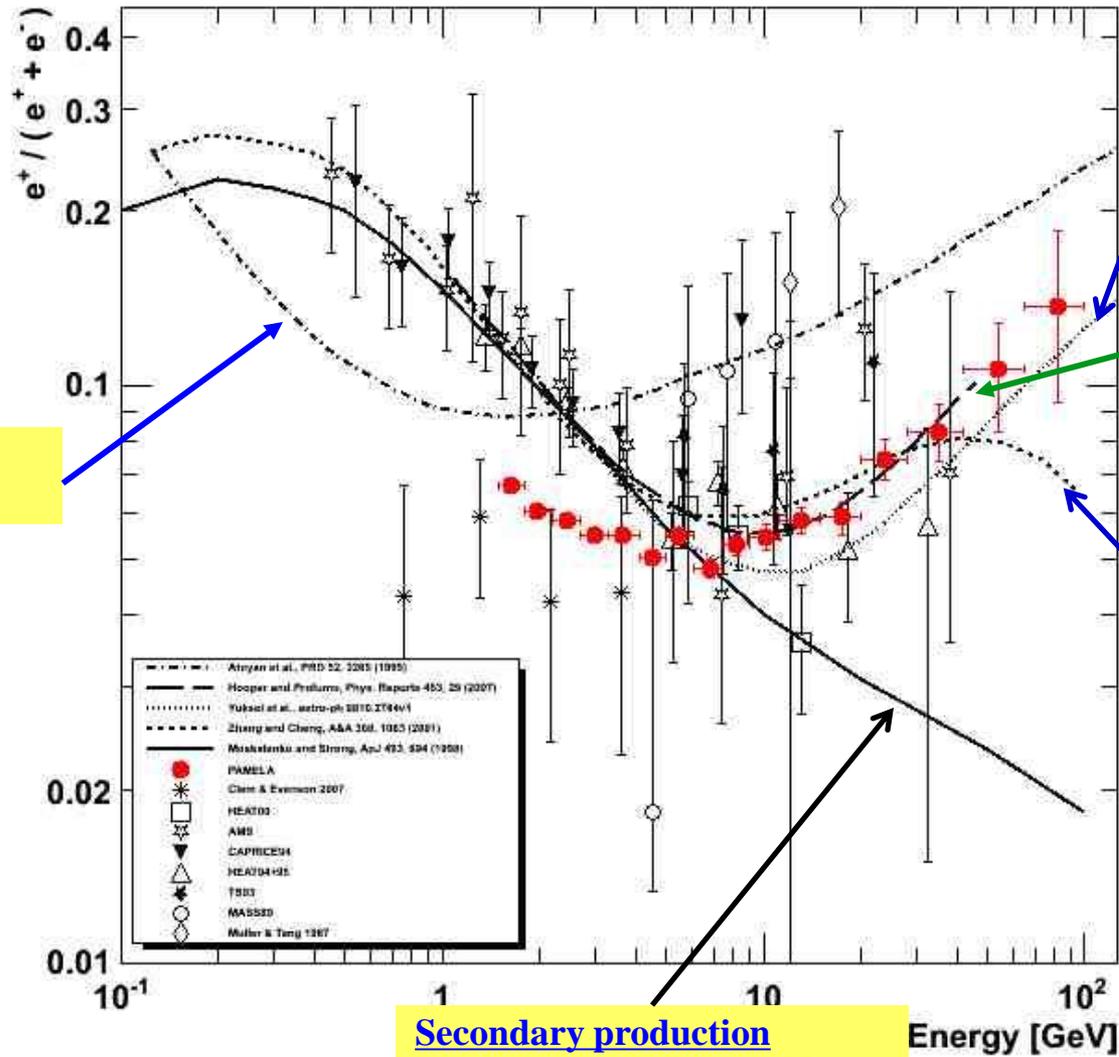


Неопределенности стандартной модели образования и распространения позитронов в Галактике



T. Delahaye et al., arXiv: 0809.5268v3

PAMELA Positron Fraction



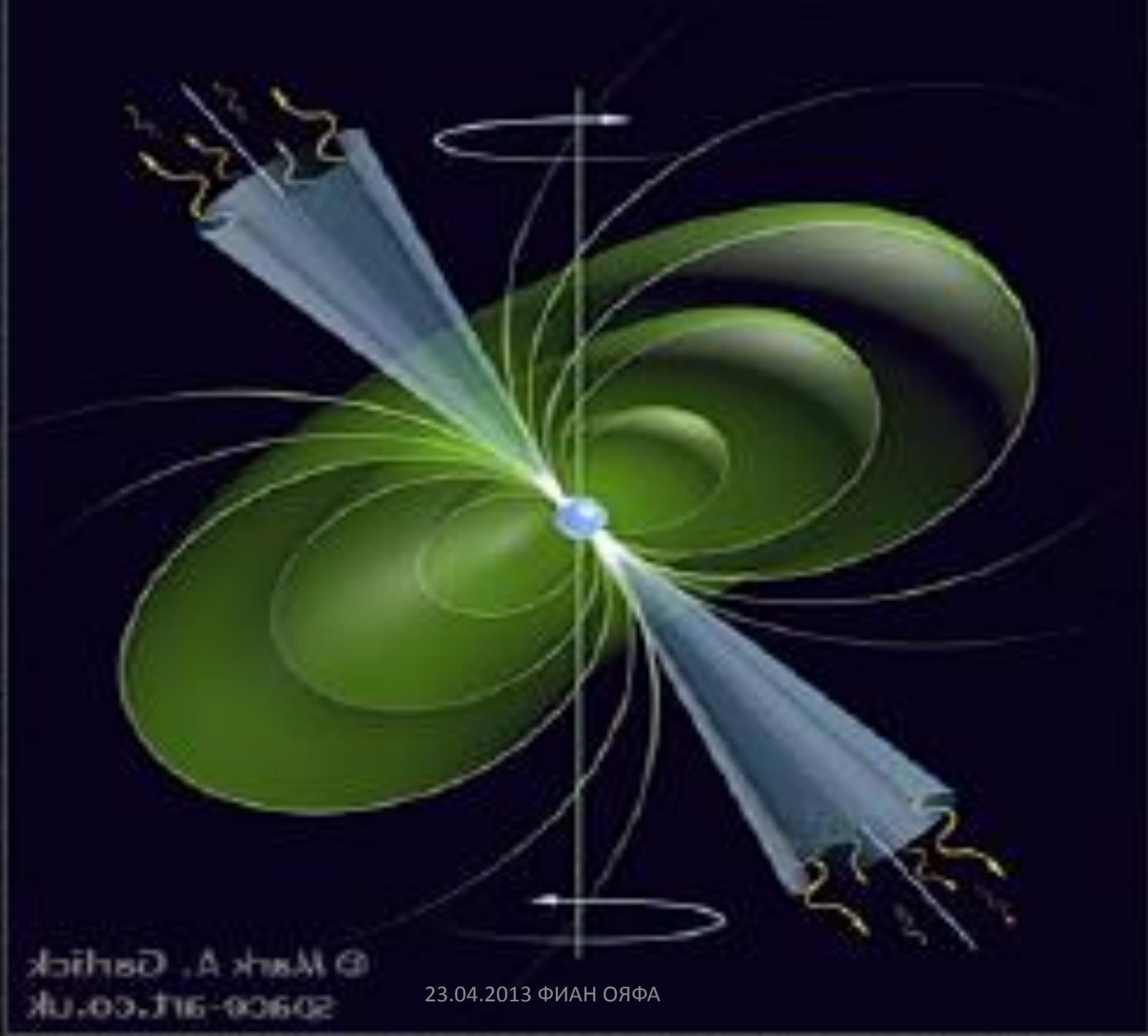
Pulsar Component
Atoyan et al. 95

Pulsar Component
Yüksel et al. 08

KKDM (mass 300 GeV)
Hooper & Profumo 07

Pulsar Component
Zhang & Cheng 01

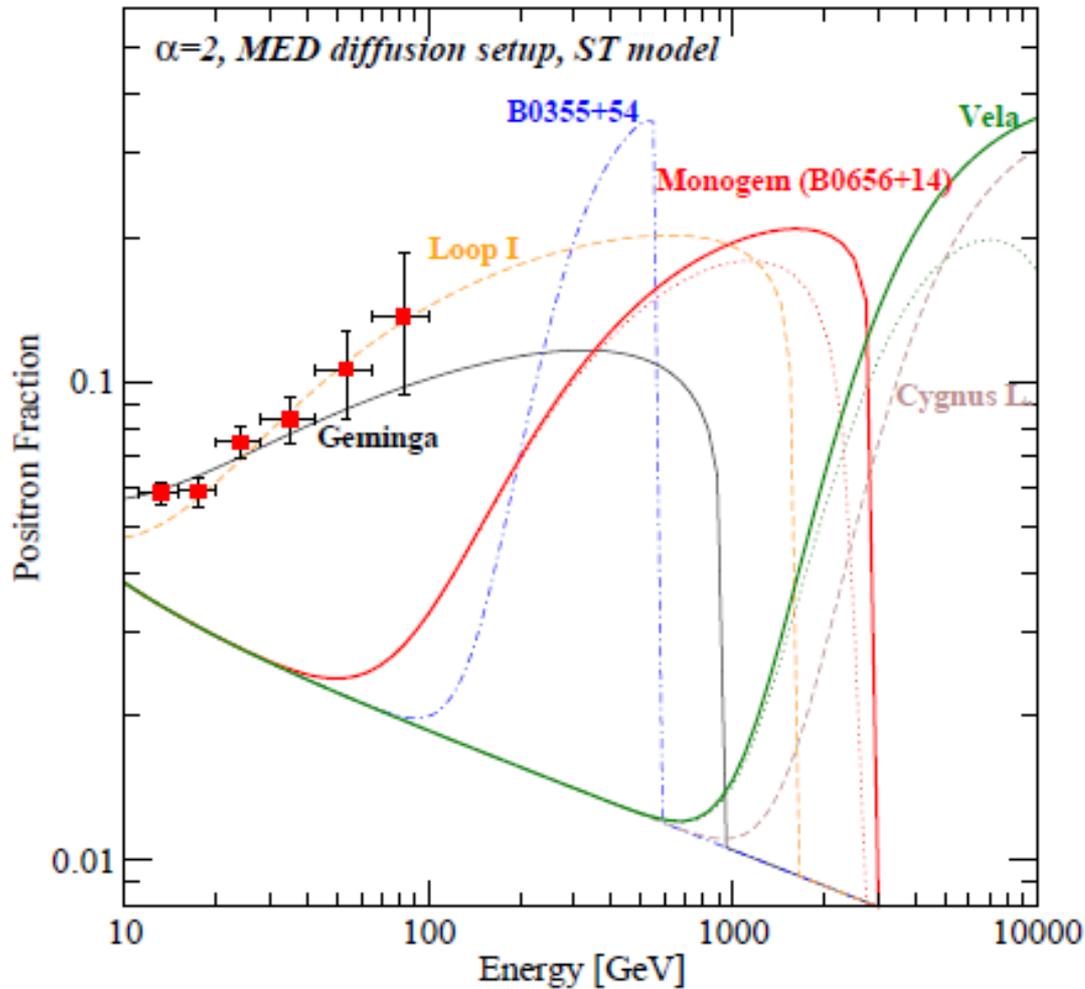
Secondary production
Moskalenko & Strong 98



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20900-917.co.uk

23.04.2013 ФИАН ОЯФА

Интерпретация данных ПАМЕЛЫ пульсарами



Интерпретация данных ПАМЕЛЫ и оценка возможностей AMS-02

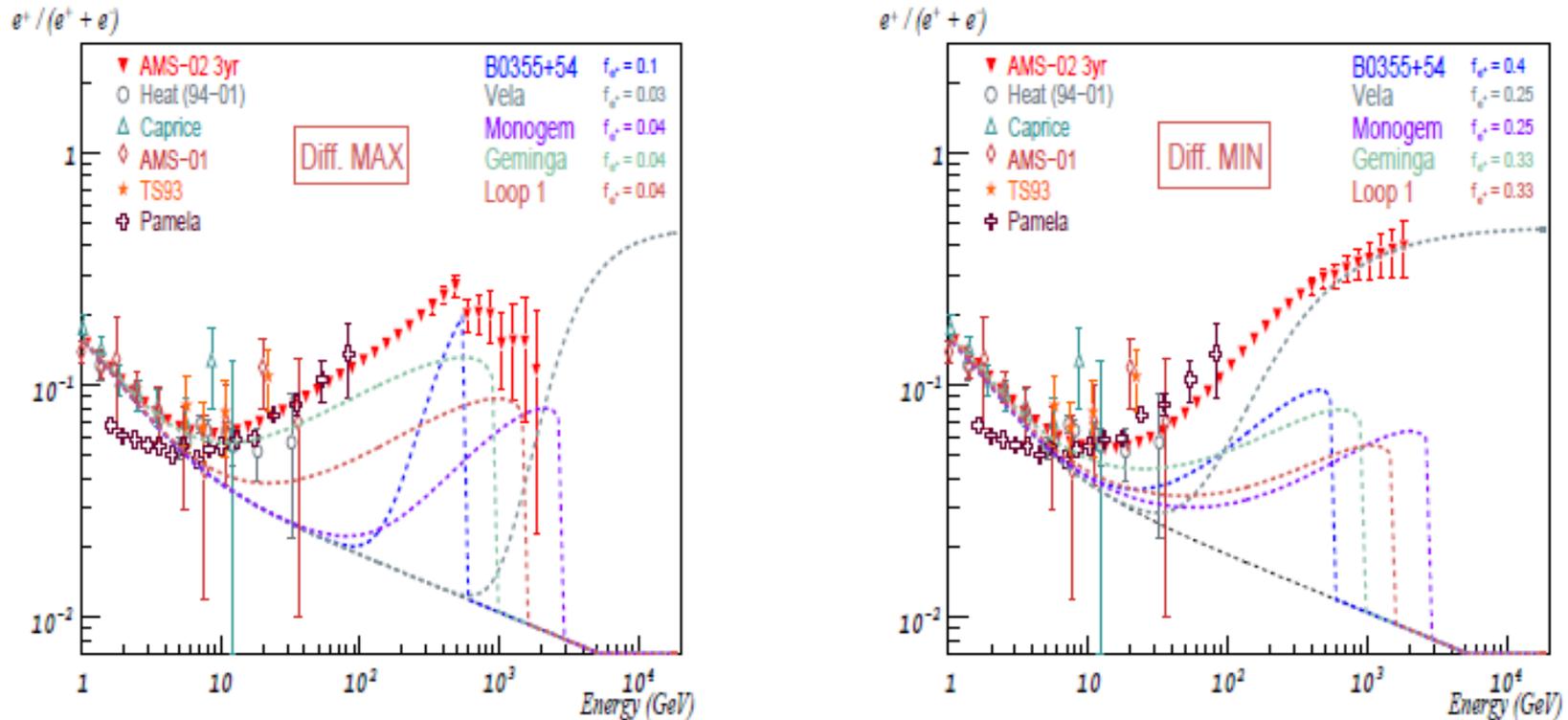
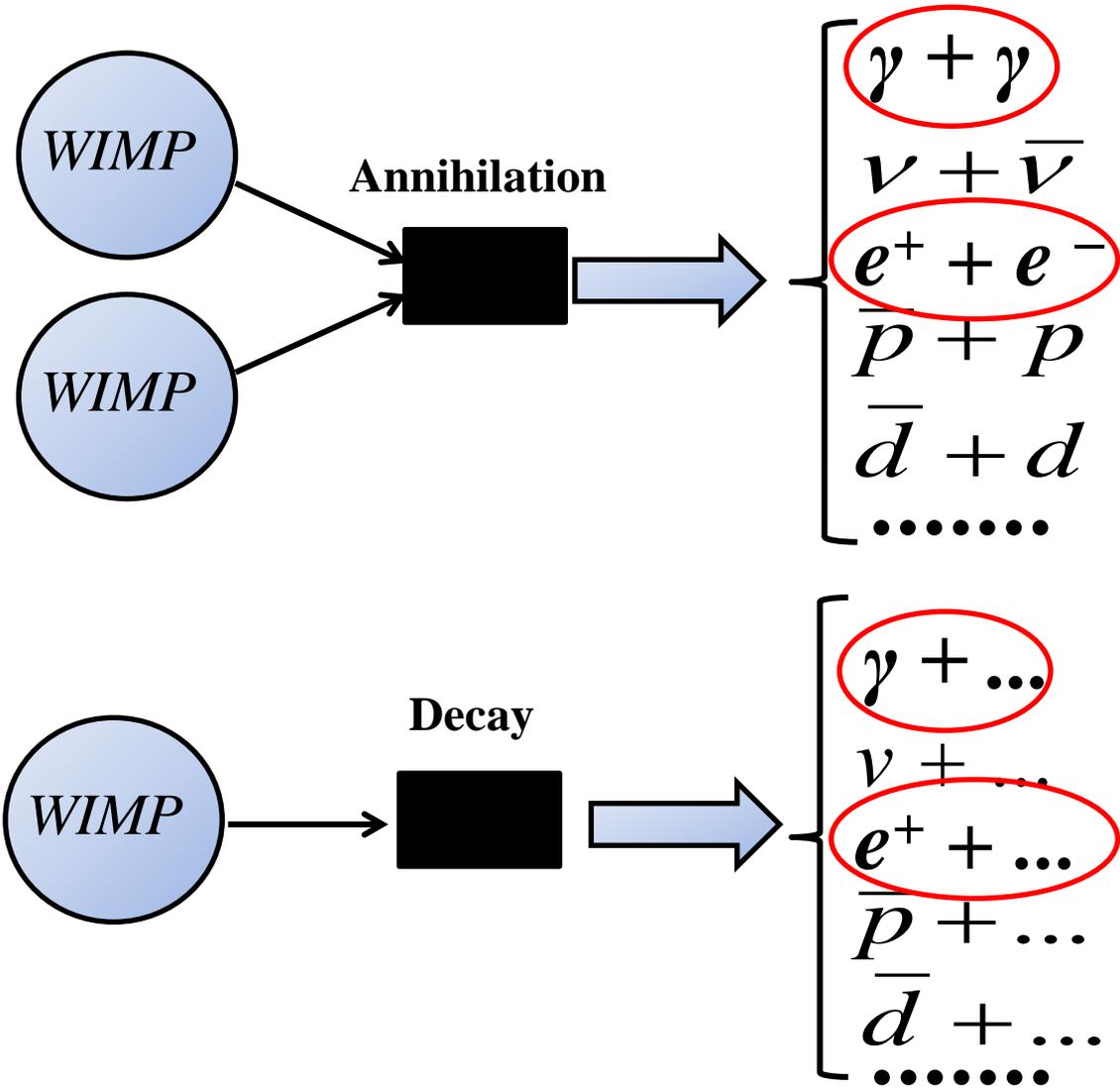
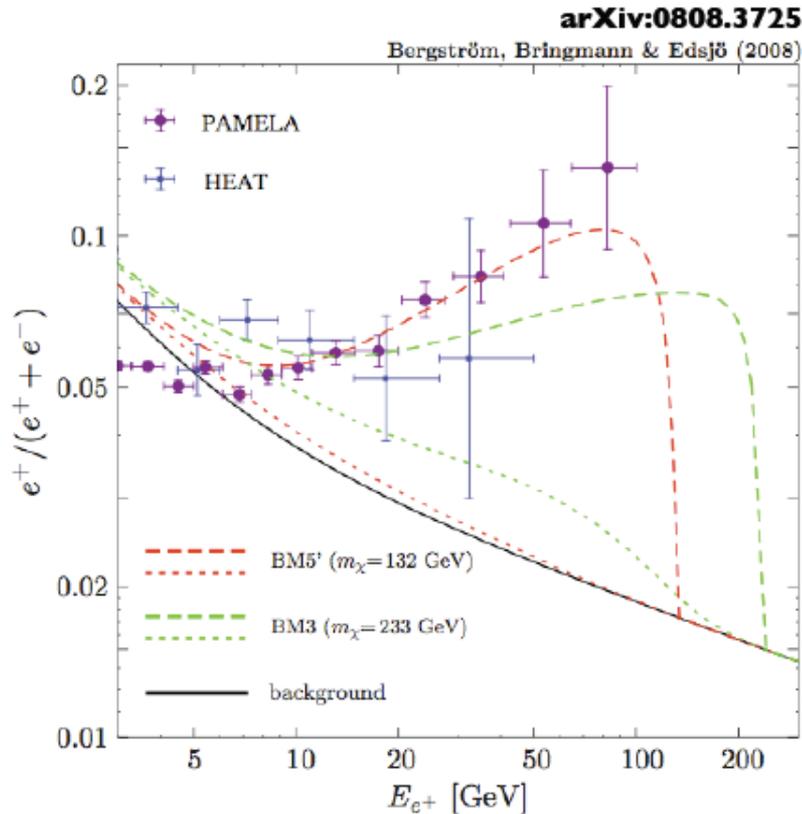


Figure 5: Positron fraction reproduced by pulsar contributions ($\alpha = 2$) for two propagation scenarios with AMS-02 capacity: MAX (left) and MIN (right) (see table 3).

Indirect methods of dark matter particle's registration

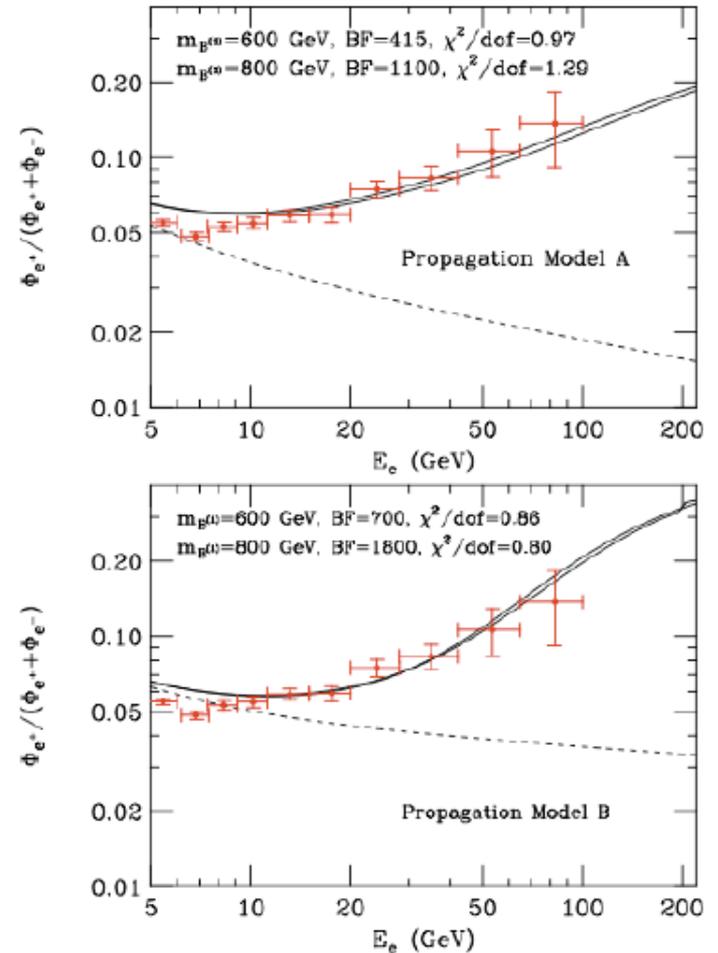


Study of origin of dark matter



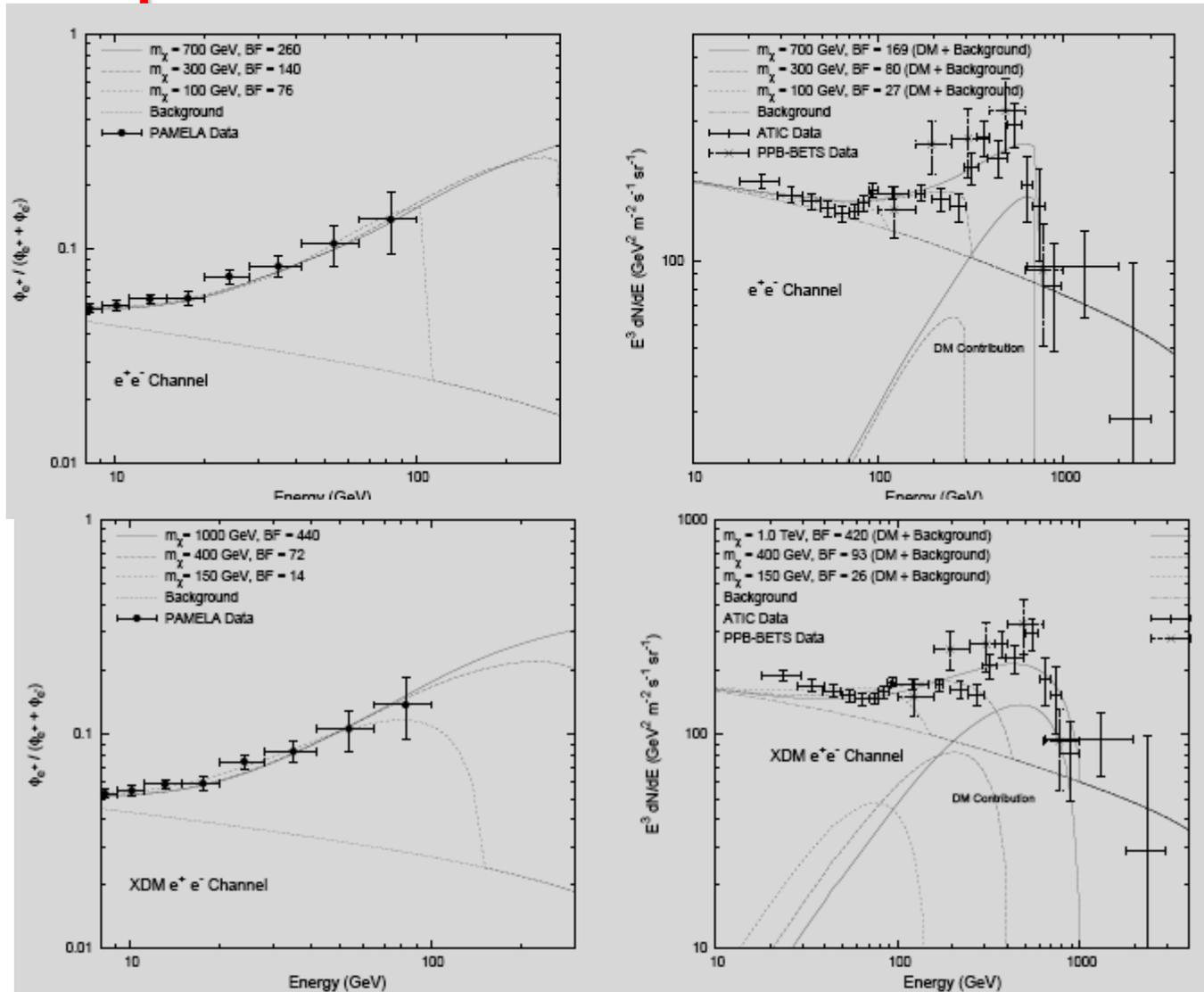
Majorana DM with **new** internal bremsstrahlung correction. NB: requires annihilation cross-section to be 'boosted' by > 1000 .

Hooper and Zurek
arXiv:0902.0593v1



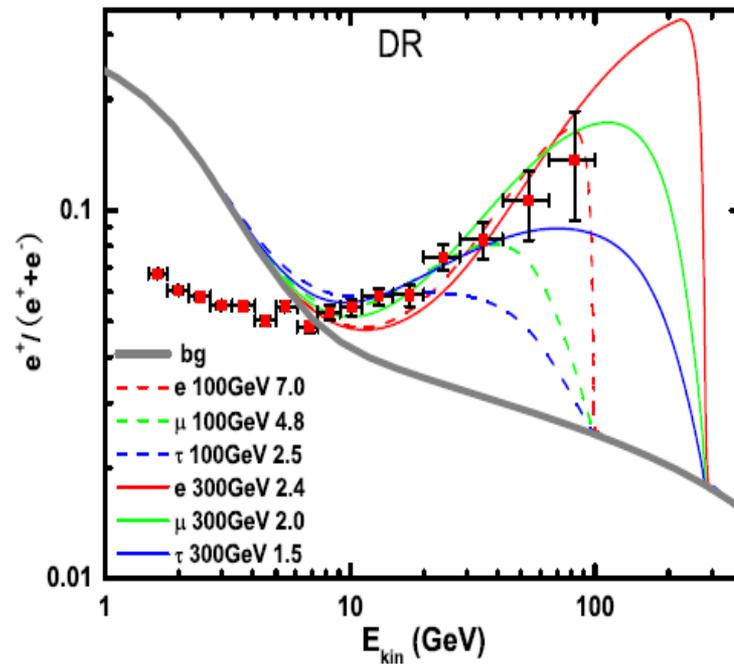
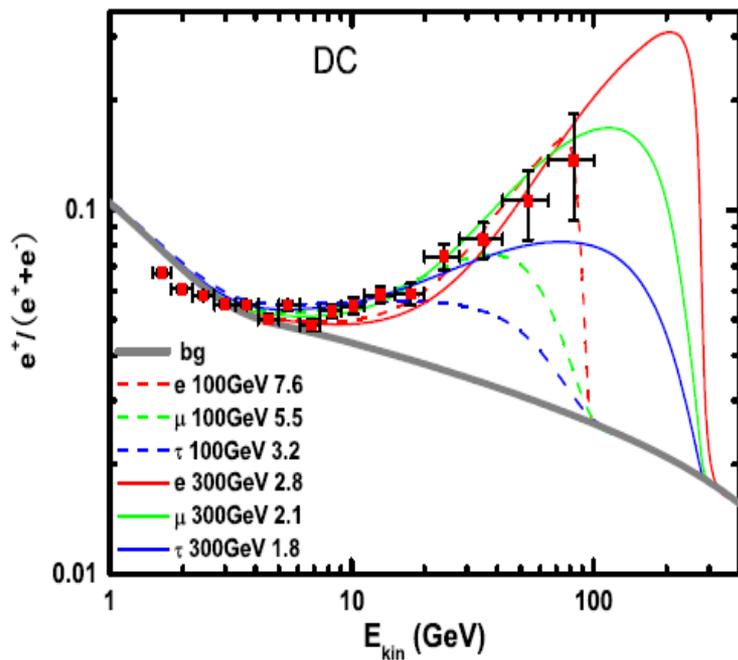
Kaluza-Klein dark matter

Interpretation: DM



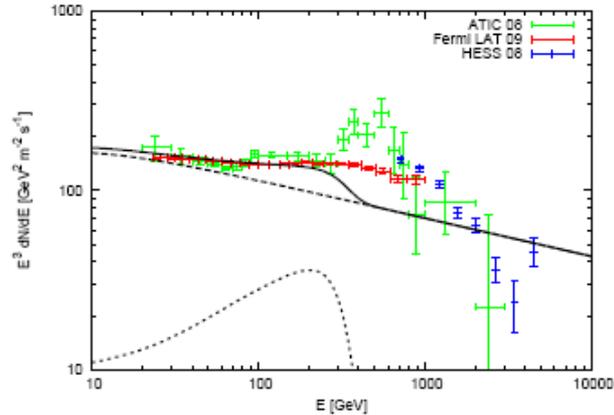
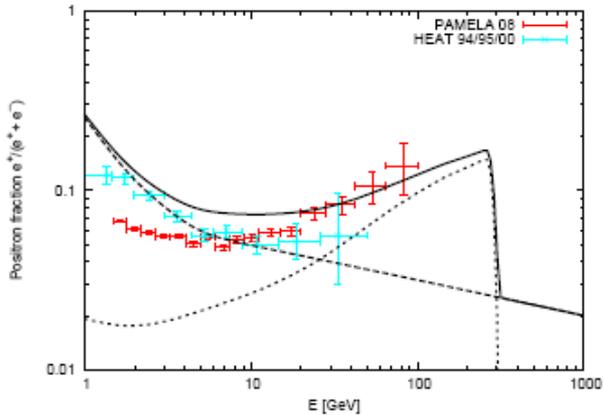
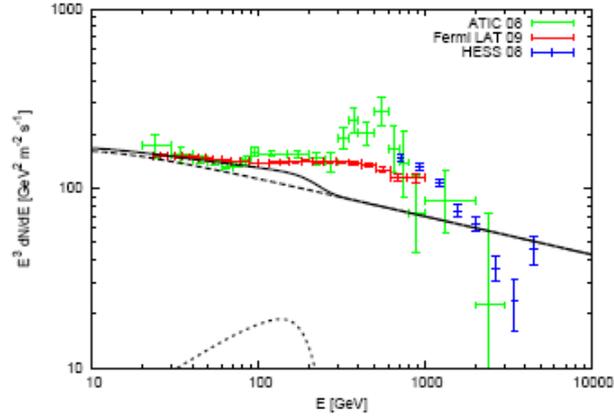
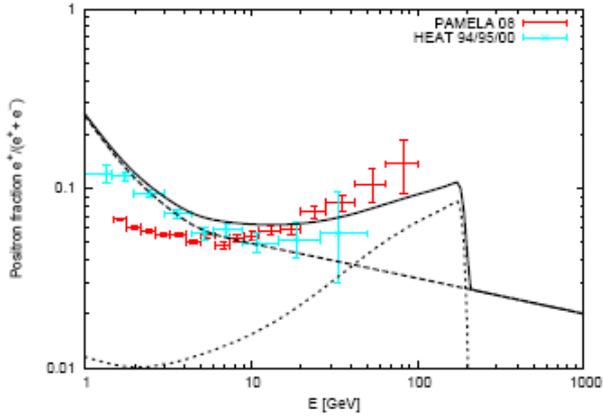
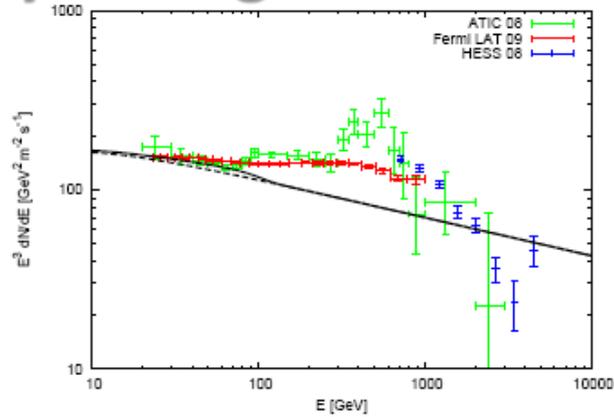
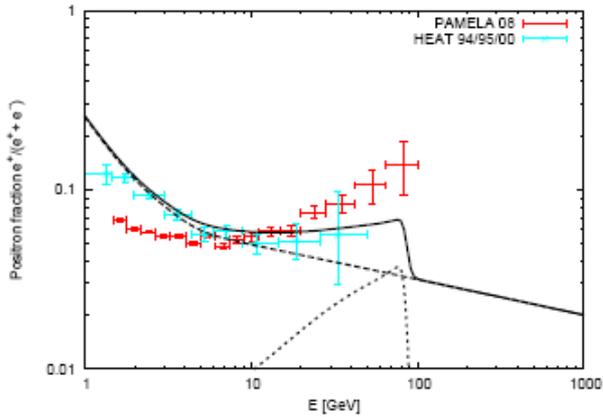
- Propose a new light boson ($m_\Phi \leq \text{GeV}$), such that $\chi\chi \rightarrow \Phi\Phi$; $\Phi \rightarrow e^+e^-, \mu^+\mu^-, \dots$
- Light boson, so decays to antiprotons are kinematically suppressed

Изучение природы темной материи



Positron fraction as function of energy from DM decaying to lepton pairs.

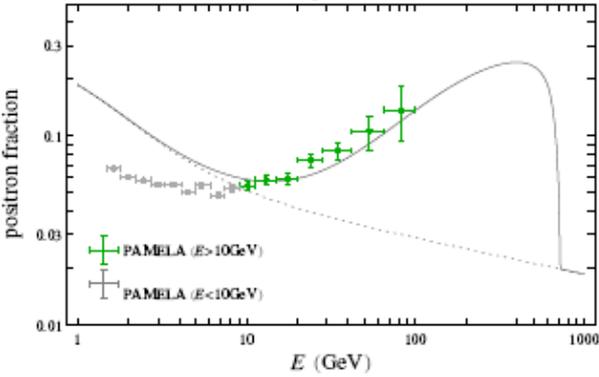
Study of origin of dark matter



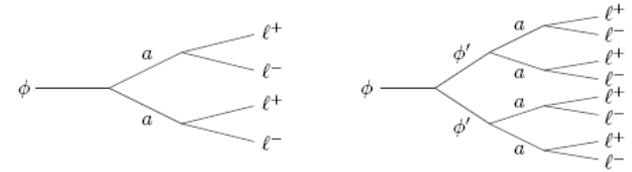
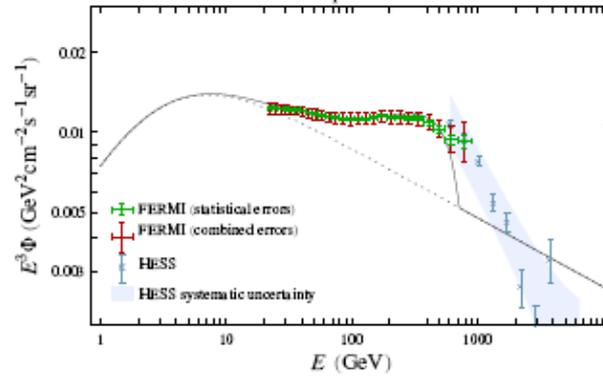
Gravitino:
 Mass 200, 400 and 600 GeV
 Decay $W^\pm l^\mp$
 Lifetime 10^{26} - 10^{27} sec.

Study of origin of dark matter

1 step to e^+e^-

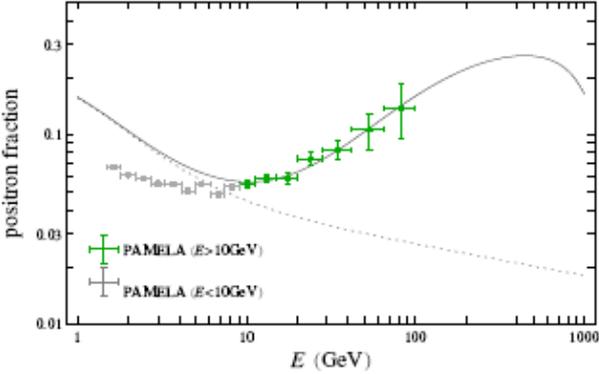


1 step to e^+e^-

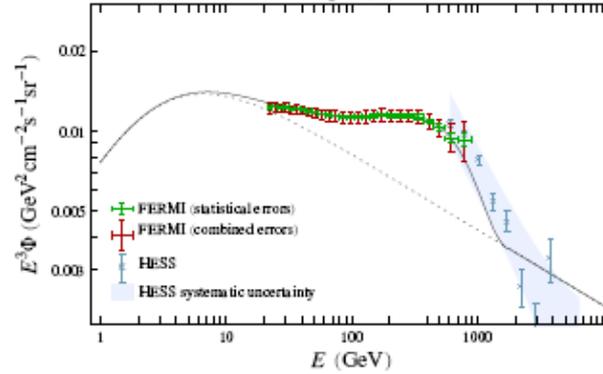


Mass ~ 1 TeV
Lifetime $\sim 10^{26}$

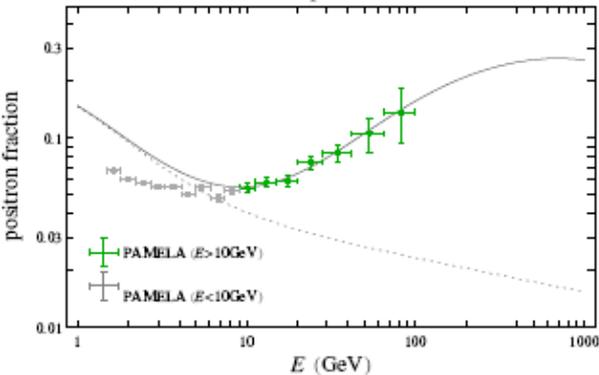
1 step to $\mu^+\mu^-$



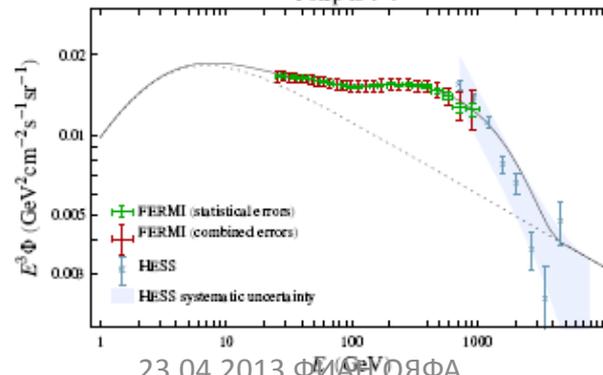
1 step to $\mu^+\mu^-$



1 step to $\tau^+\tau^-$

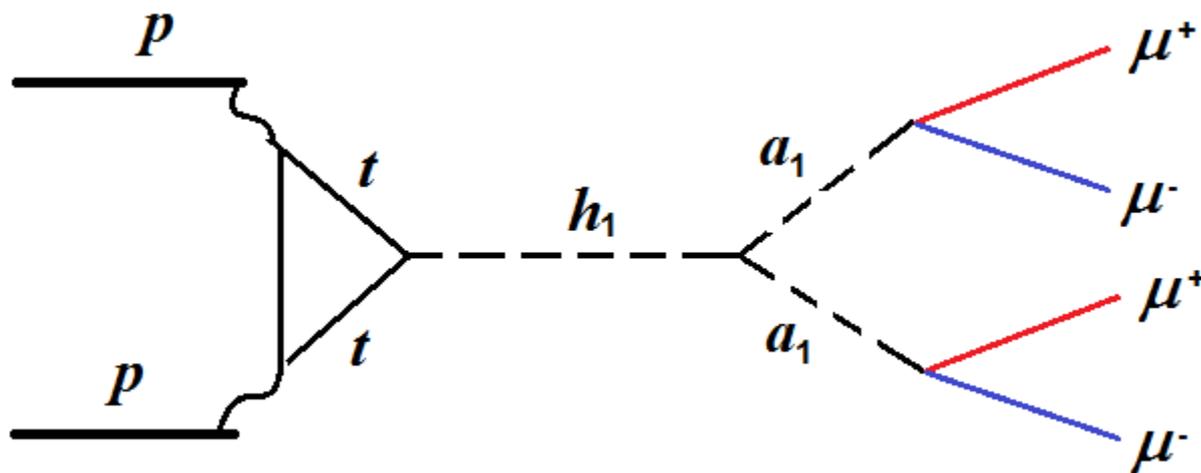


1 step to $\tau^+\tau^-$



Суперсимметрия

Описанная модель имеет свои отличительные эффекты на ускорителе: рождение a_1, h_1 .



$$m_x \approx 160 \text{ ГэВ}$$

$$m_{a1} \sim 1 \text{ ГэВ}$$

$$m_{a2} \approx 320 \text{ ГэВ}$$

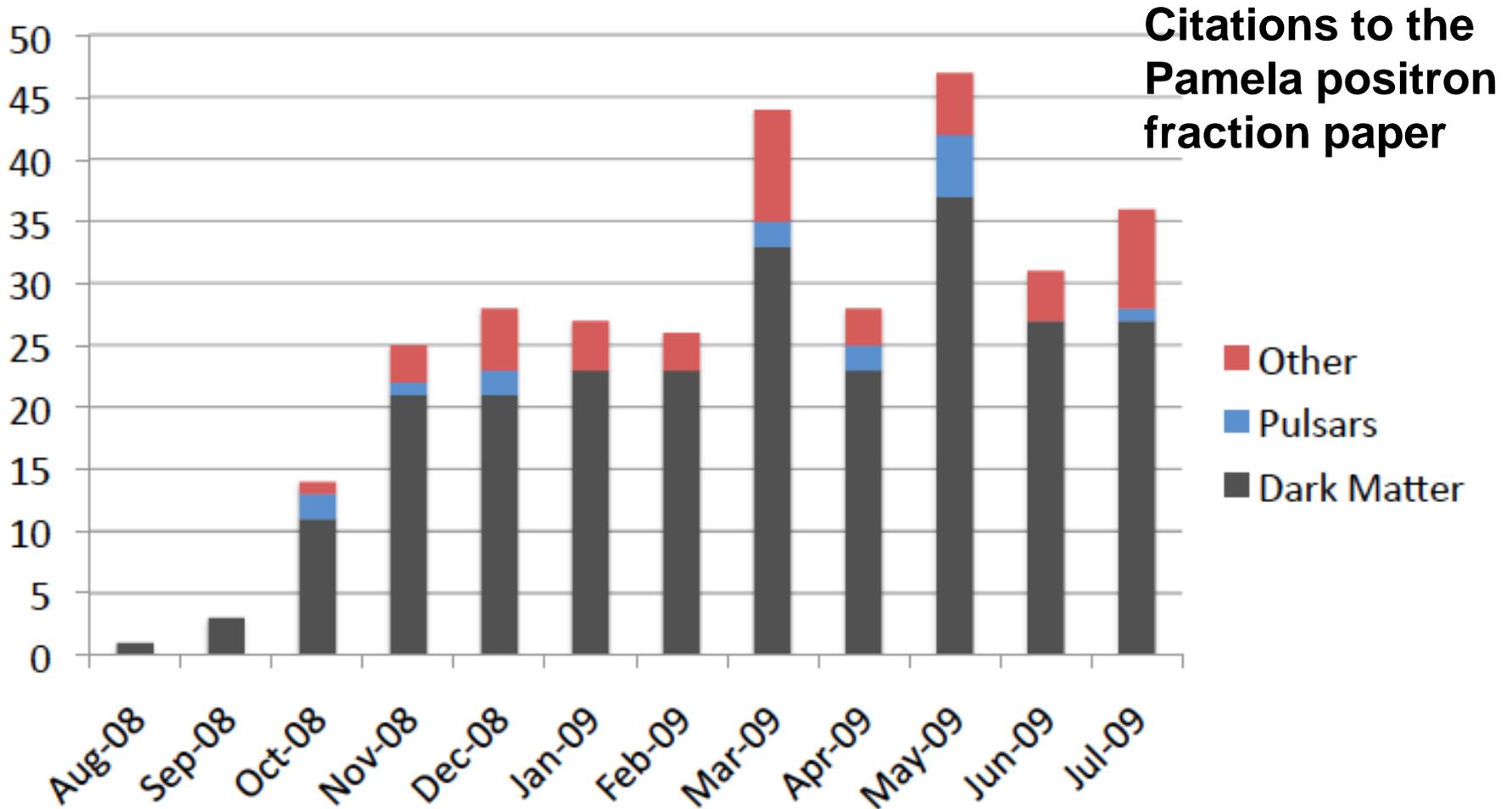
$$m_{h1} > 115 \text{ ГэВ}$$

Рождение a_2 подавлено в этой модели из-за его малой константы взаимодействия.

Dark Matter

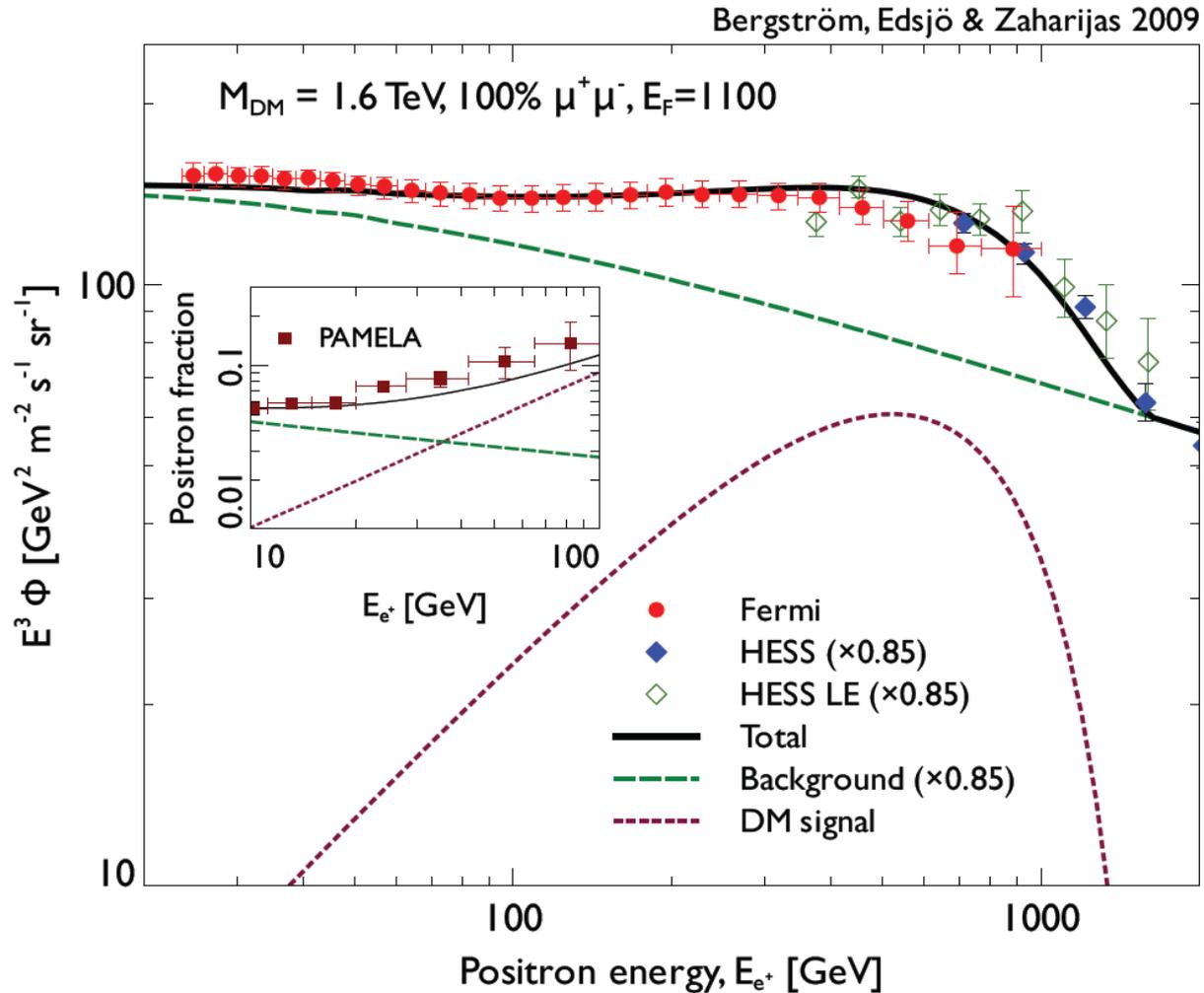
Pamela

Fermi bump attention

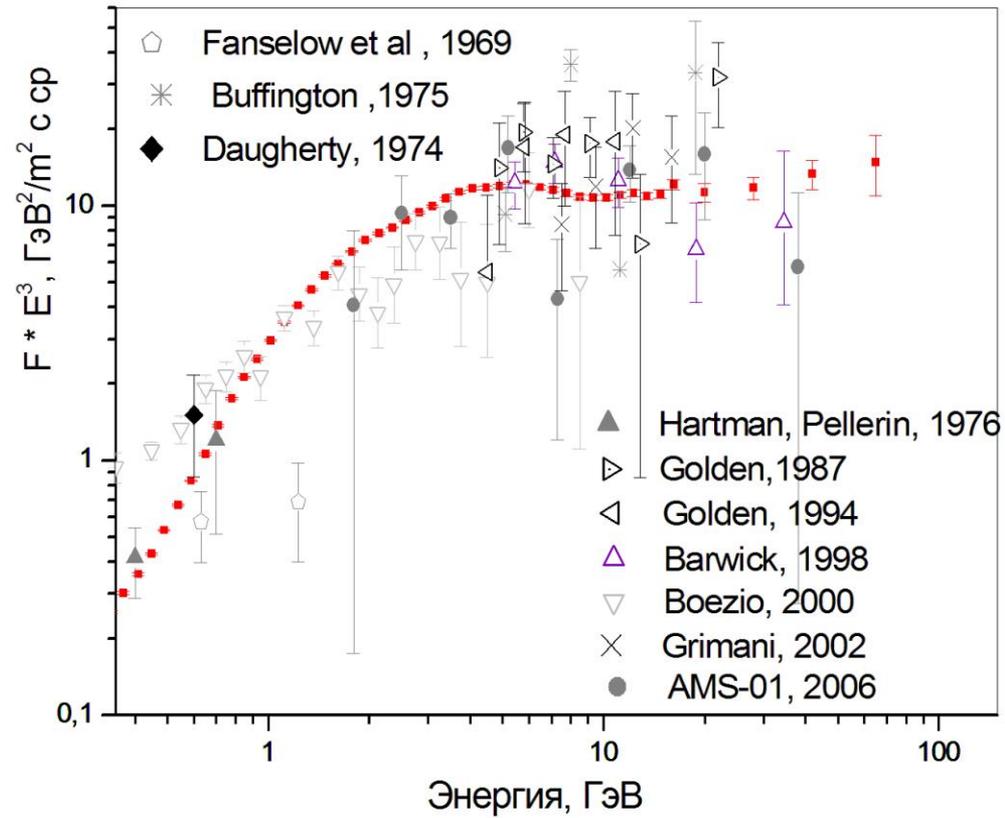


Fermi ($e^+ + e^-$) PAMELA

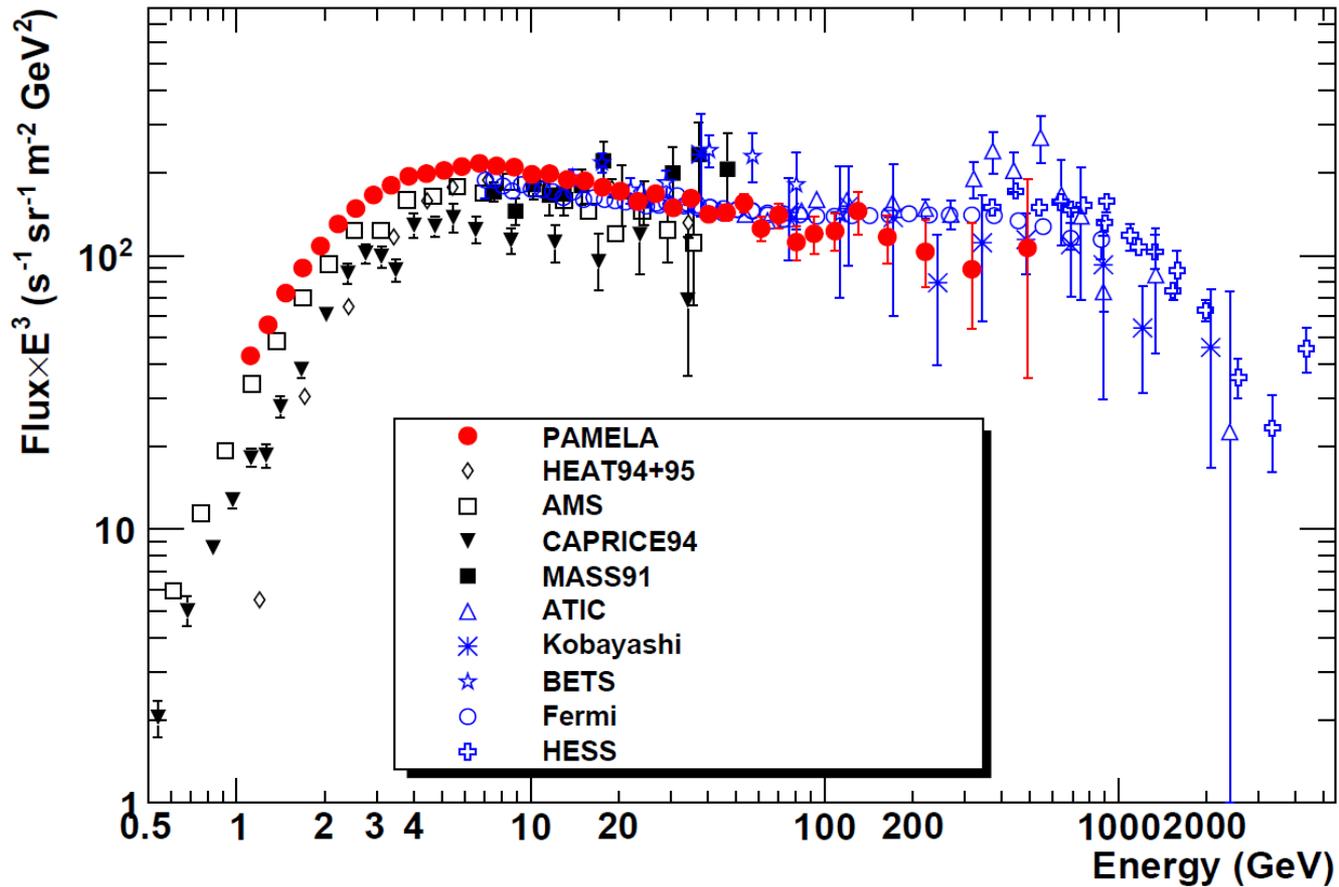
Bergstrom et al. astro-ph 0905.0333v1



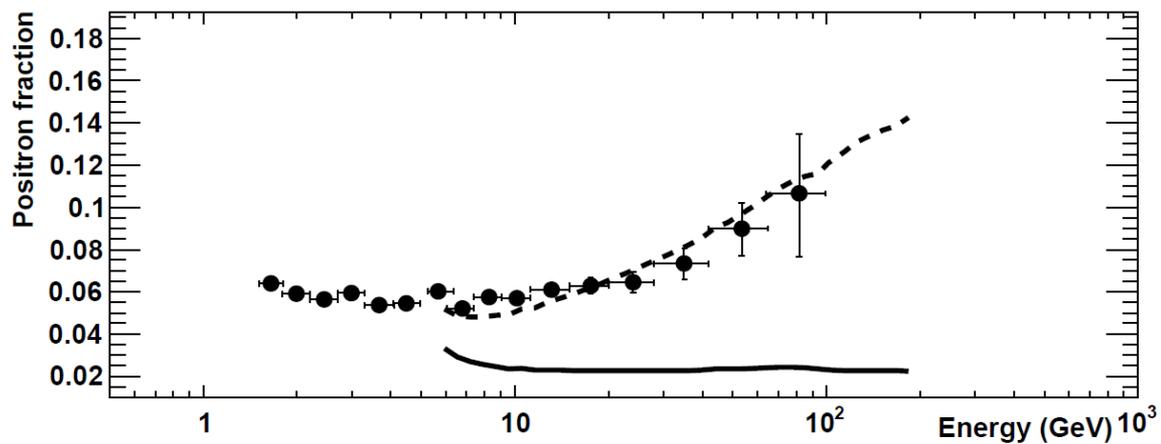
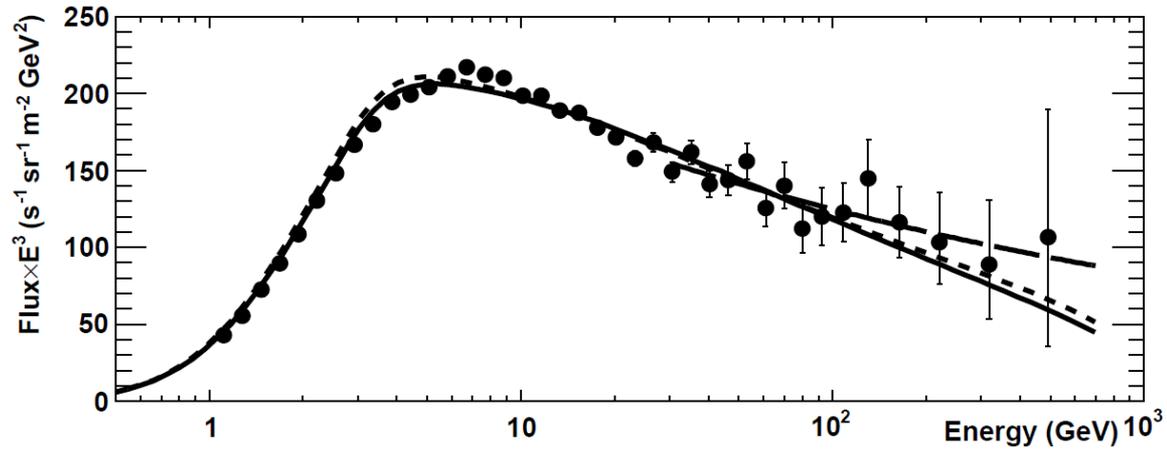
Спектр позитронов



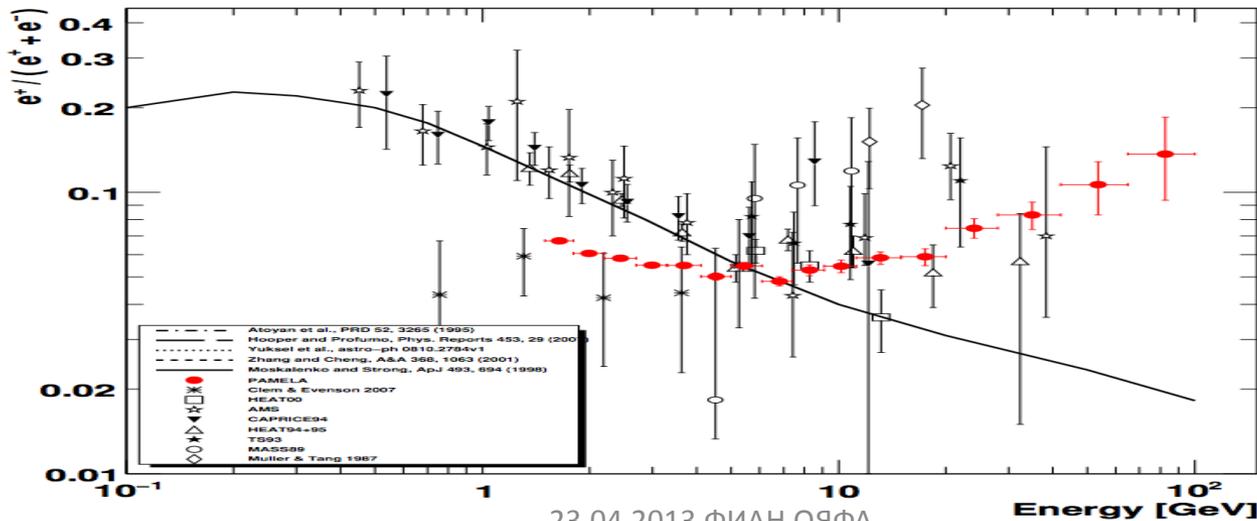
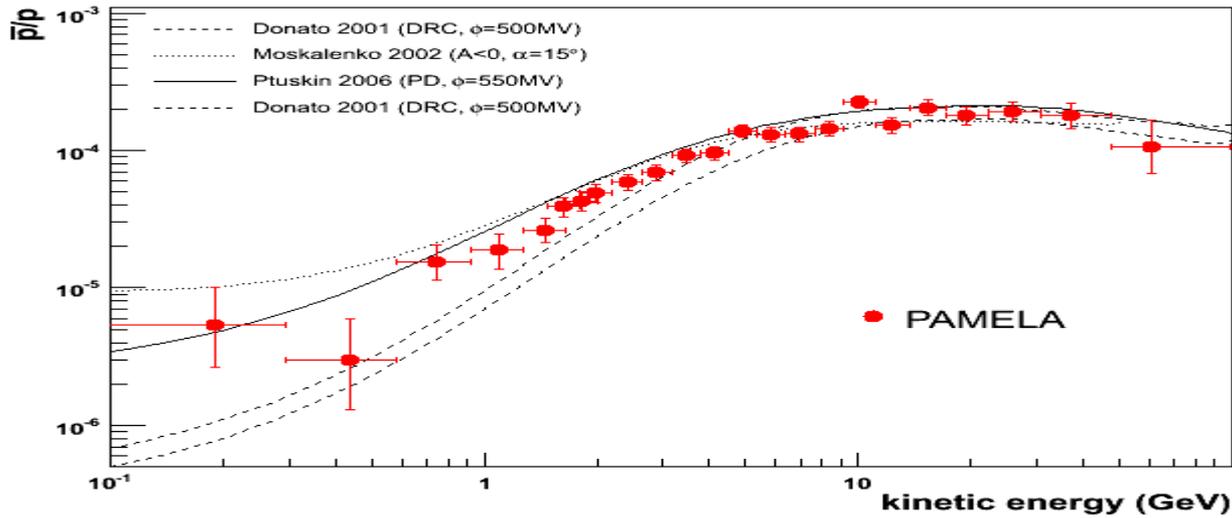
Спектр электронов



Избыток электронов



A Challenging Puzzle for Dark Matter Interpretation





Top ten physics stories of the year 2008

INSIDE SCIENCE RESEARCH --- PHYSICS NEWS UPDATE The American Institute of Physics
Bulletin of Research News Number 879 #1, December 22, 2008 www.aip.org/pnu by Phil
Schewe

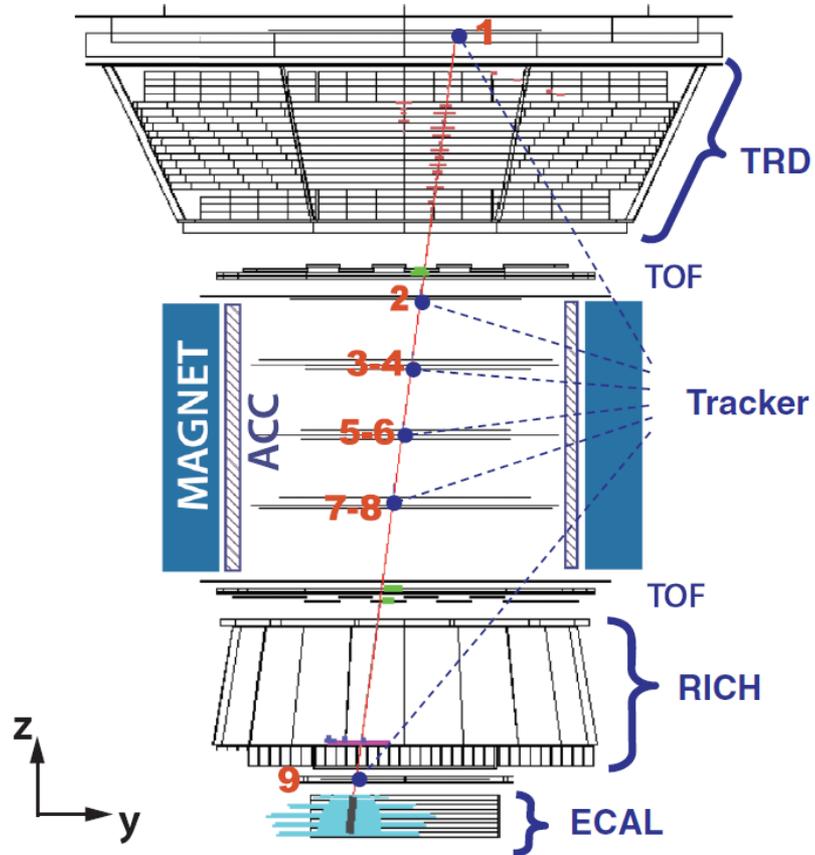
- *SUPERCONDUCTORS*
- *LARGE HADRON COLLIDER*
- *PLANETS*
- *QUARKS*
- *FARTHEST SEEABLE THING*
- *ULTRACOLD MOLECULES*
- *DIAMOND DETECTORS*

• COSMIC RAYS

Another mystery pertains to the findings of two detectors held aloft-one by a balloon and one on a satellite-looking for oddities in the number of antiparticles arriving with regular particles among cosmic rays reaching Earth. They see an excess of such particles which some interpret as evidence for “dark matter,” a class of very-weakly-interacting particles not seen before. Scientists associated with the balloon-borne ATIC detector (Nature, 20 Nov) and the satellite **PAMELA** (<http://arxiv.org/abs/0810.4995>)

- *LIGHT PASSES THROUGH OPAQUE MATTER*
- *MACROSCOPIC FEEDBACK COOLING*

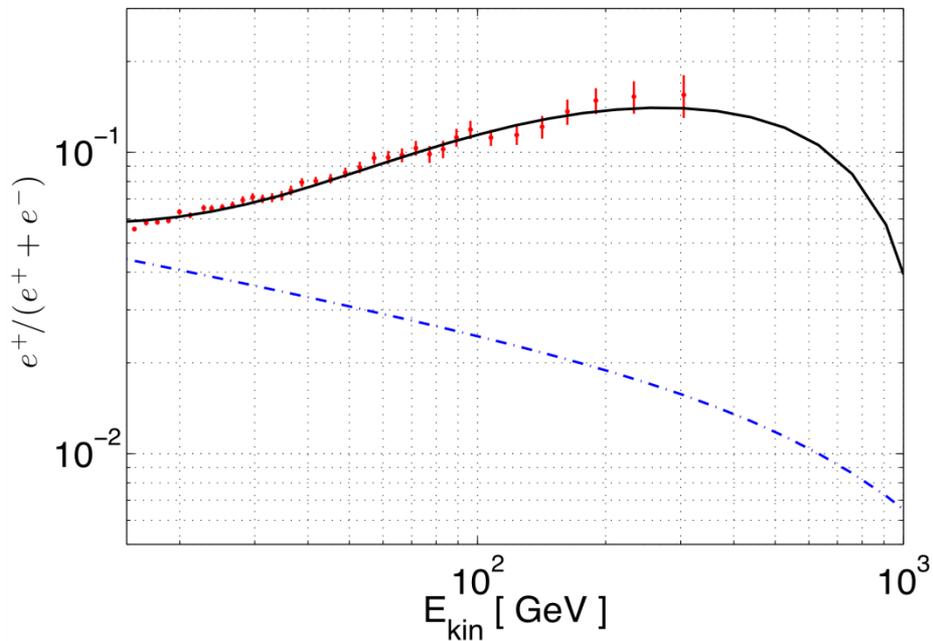
AMS-02



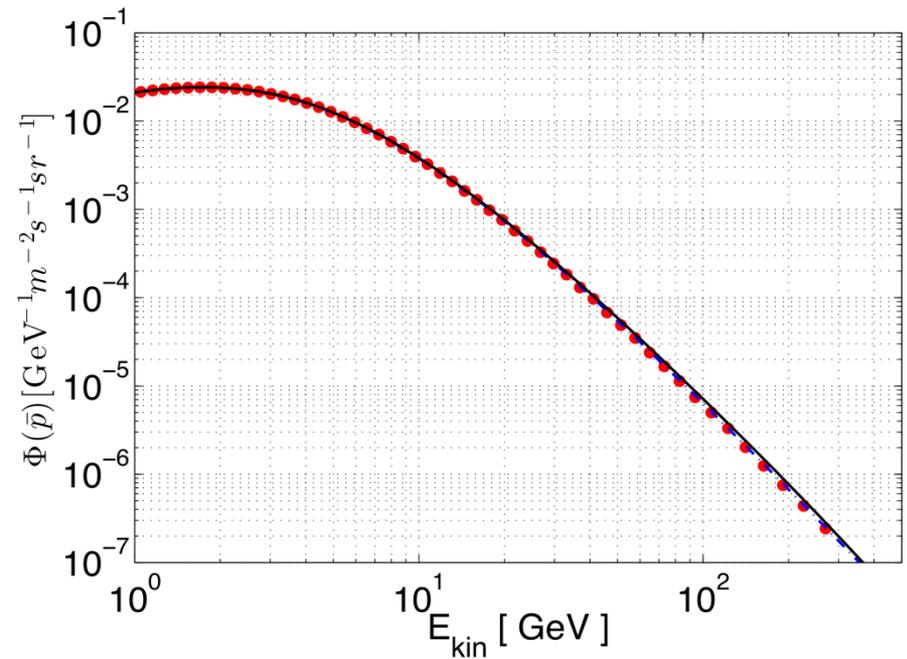
Example: DM DM \rightarrow $\tau^+\tau^-$

Andrea De Simone, Antonio Riotto, Wei Xue
CERN-PH-TH/2013-054 (April 3, 2013)

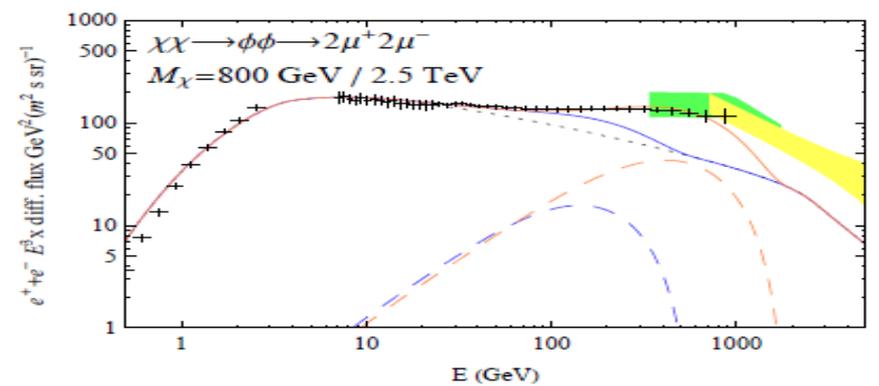
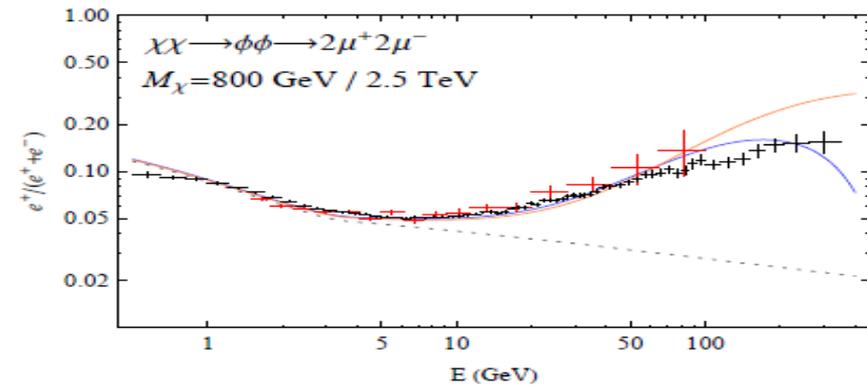
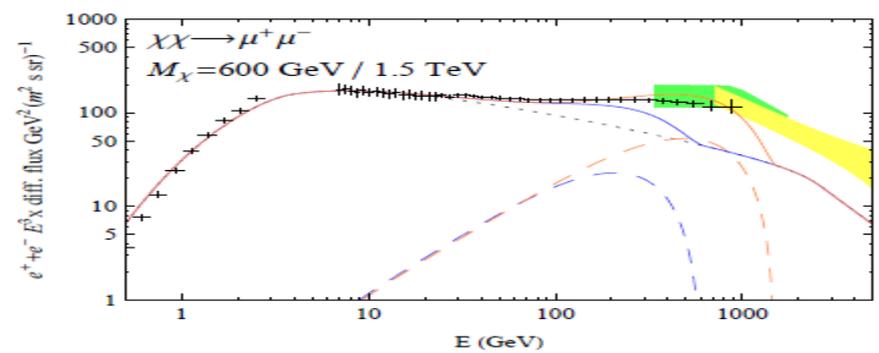
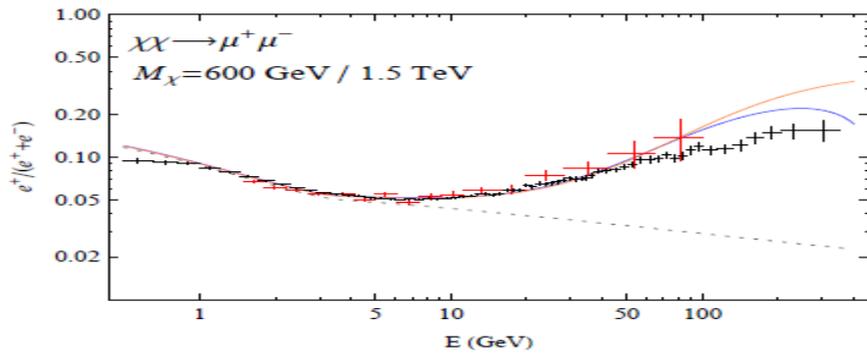
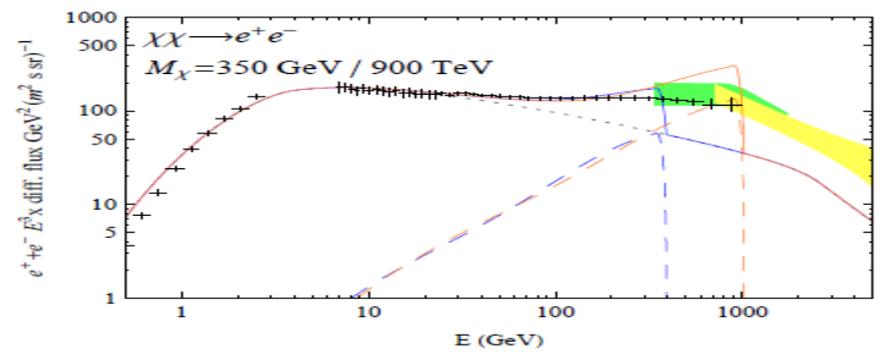
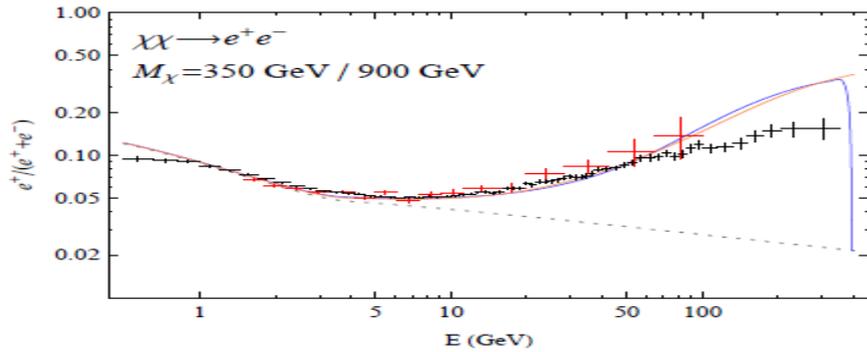
$$m_{\text{DM}} = 900 \text{ GeV}$$
$$\sigma v = 5 \times 10^{-23} \text{ cm}^3 \text{ s}^{-1}$$



AMS Data: e^+ fraction

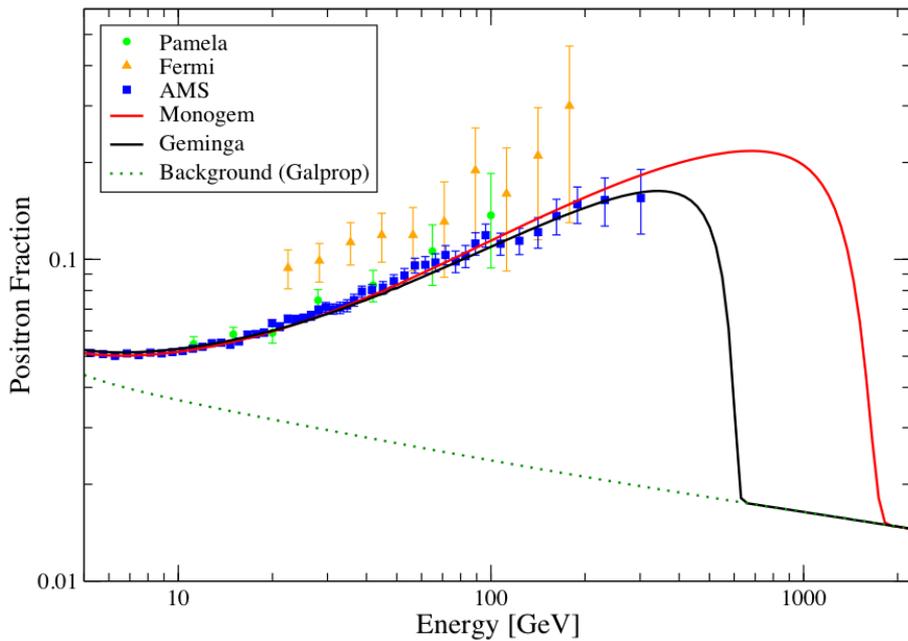


AMS expectation: $\Phi(p)$

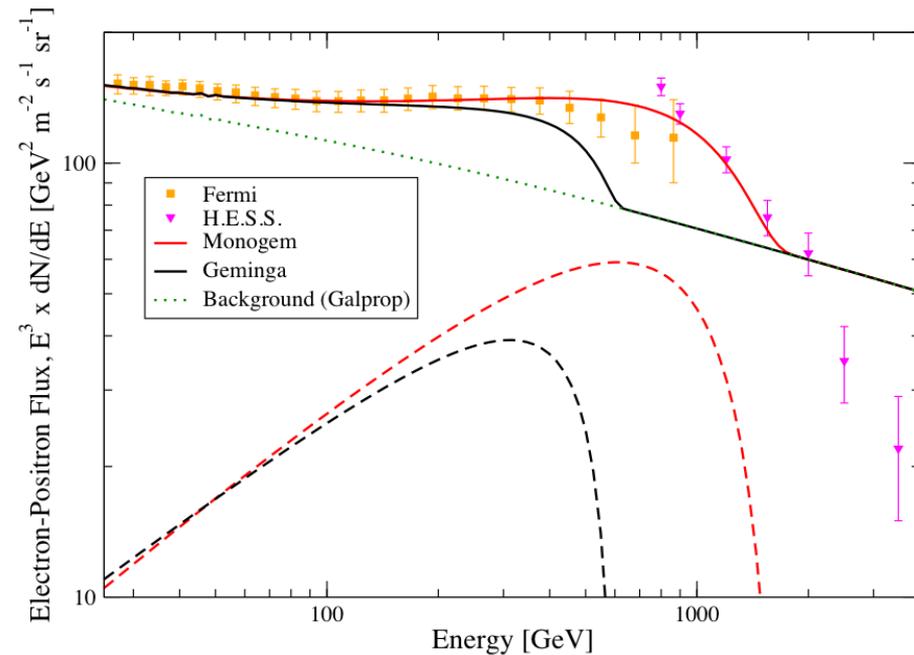


Example: Pulsars

Tim Linden and Stefano Profumo
arXiv:1304.1791v1 [astro-ph.HE] 5 Apr 2013

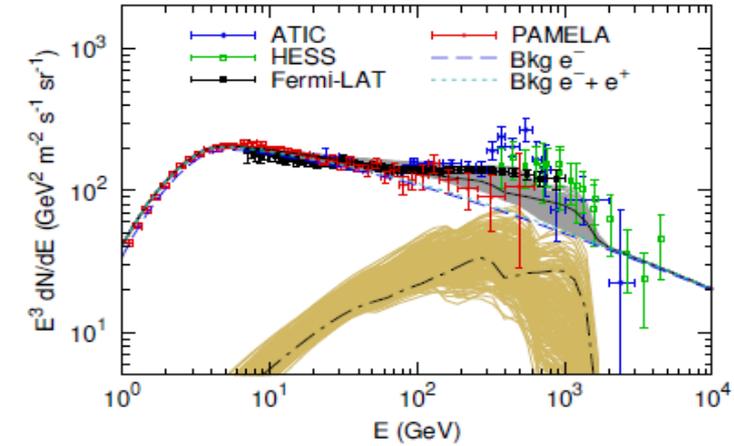
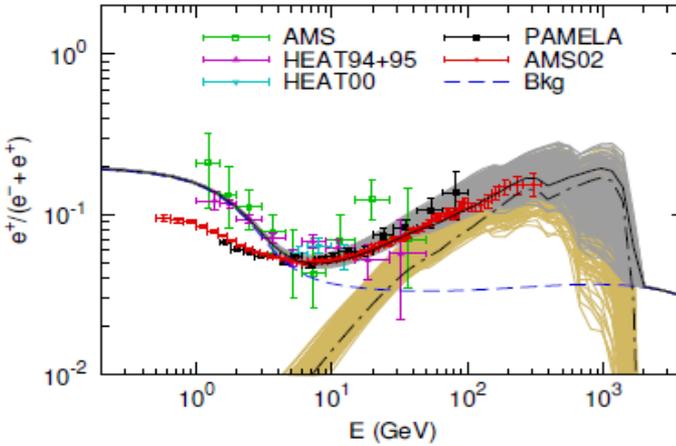
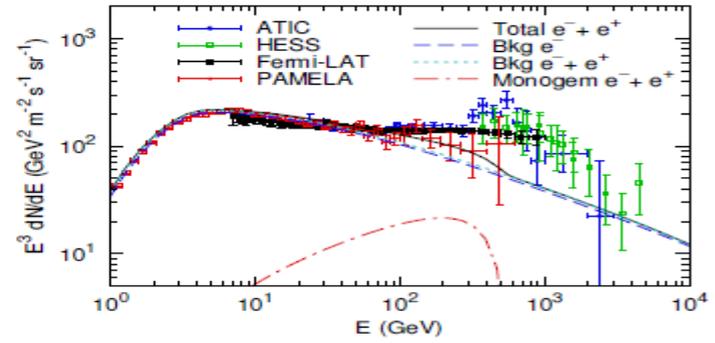
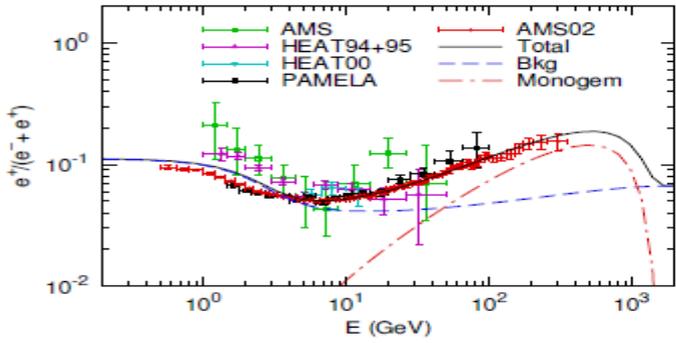
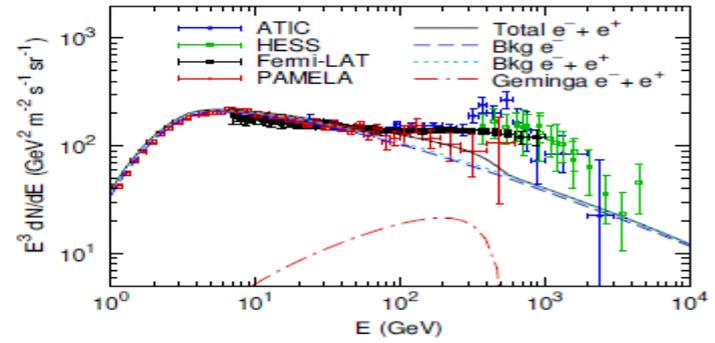
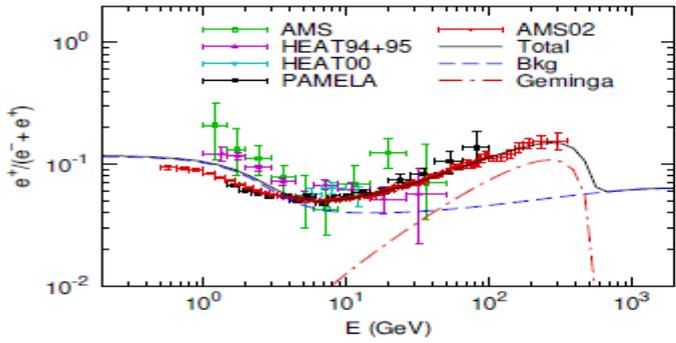


AMS Data: e^+ fraction

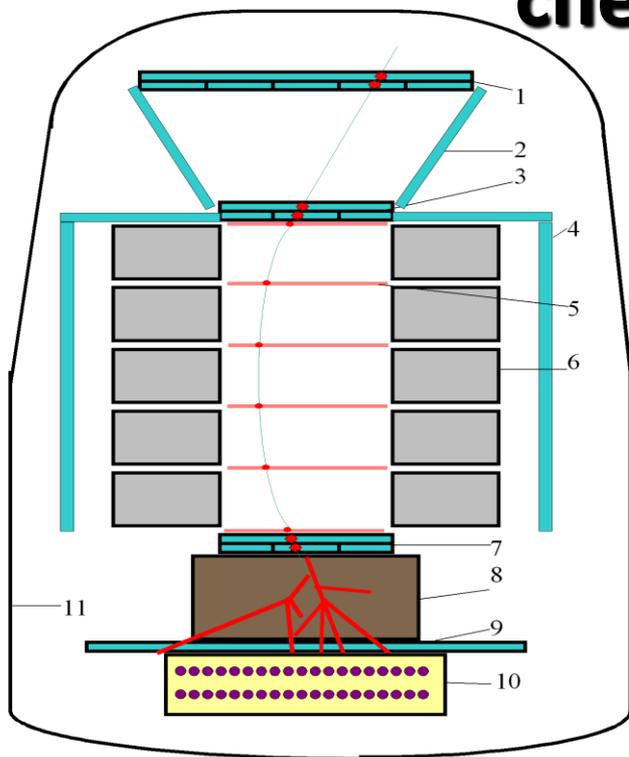


Fermi/H.E.S.S.: e^-+e^+

See also: Cholis and Hooper, arXiv:1304.840v1 [astro-ph.HE] 6 Apr 2013



Физическая схема магнитного спектрометра ПАМЕЛА



Измерение:

- времени пролета (β);
- отклонения в магнитном поле;
- энергетических потерь во всех детекторах;
- числа нейтронов.

Определение:

- типа частицы (лептон/адрон);
- заряда частицы ($\pm Z$);
- массы частицы (A);
- жесткости и энергии (R and E);
- направление прилета;

МАГНИТНЫЙ СПЕКТРОМЕТР ПАМЕЛА

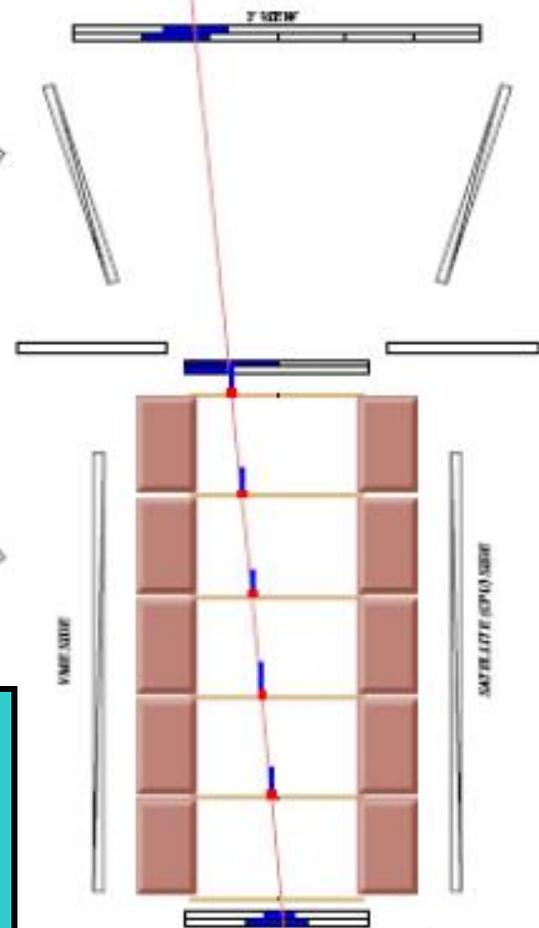
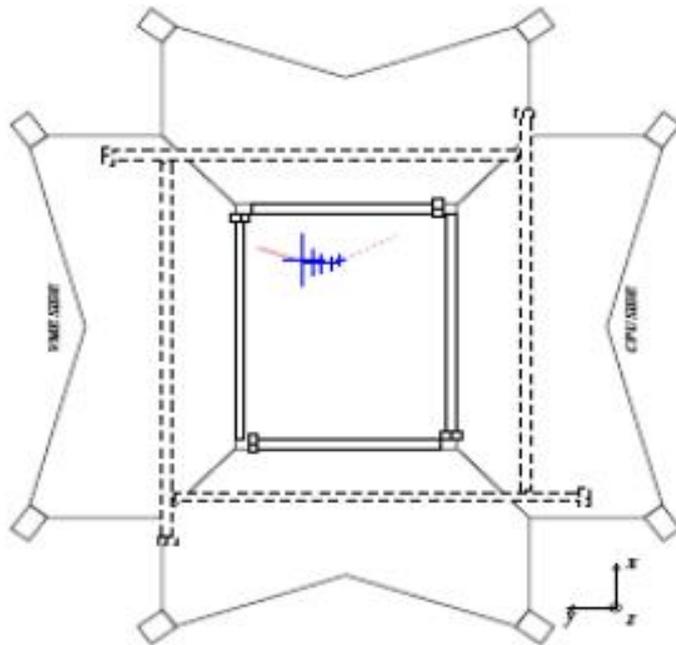
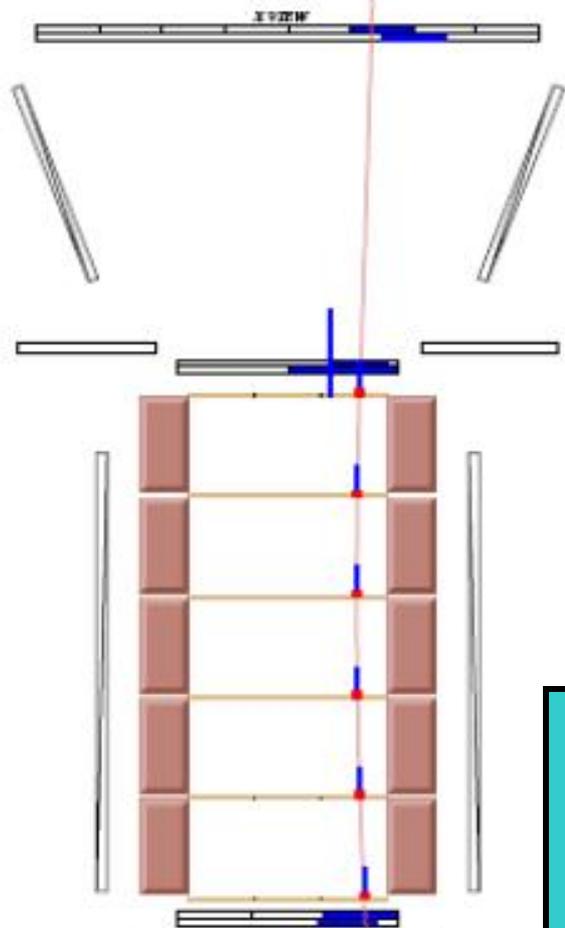
- 1, 3, 7- СЦИНТИЛЛЯЦИОННАЯ ВРЕМЯПРОЛЕТНАЯ СИСТЕМА;
2, 4- СЦИНТИЛЛЯЦИОННАЯ ОХРАННАЯ СИСТЕМА;
5- ПОЛУПРОВОДНИКОВАЯ СТРИПОВАЯ КООРДИНАТНАЯ СИСТЕМА (ШЕСТЬ ДВОЙНЫХ СЛОЕВ);
6- МАГНИТНАЯ СИСТЕМА (ПЯТЬ СЕКЦИЙ);
8- ПОЛУПРОВОДНИКОВЫЙ СТРИПОВЫЙ ПОЗИЦИОННО-ЧУВСТВИТЕЛЬНЫЙ КАЛОРИМЕТР;
9- СЦИНТИЛЛЯЦИОННЫЙ ЛИВНЕВОЙ ДЕТЕКТОР;
10- НЕЙТРОННЫЙ ДЕТЕКТОР;
11- ГЕРМОКОНТЕЙНЕР.

Ресурс-ДК №1. «ЦСКБ-Прогресс»

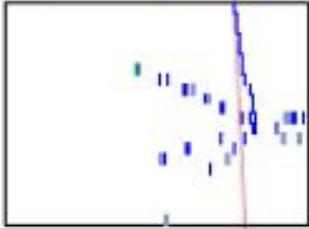


Параметры рабочей орбиты:

- наклонение орбиты, град	70
- минимальная высота орбиты, км	361
- максимальная высота орбиты, км	604
Срок активного существования	3 года
Масса полностью собранного и заправленного КА, кг	не более 6550
Максимальная длина КА, мм	7930
Максимальный диаметр КА, мм	2720
Площадь солнечной батареи, м ²	36



**Экспериментальные
результаты: 0.763 GeV/c**
Аннигиляция антипротона



PALETTE

TOP, TRK, CALO, S4 [MP]:

0	0-2	3-10	11-100	101-1000	>1000
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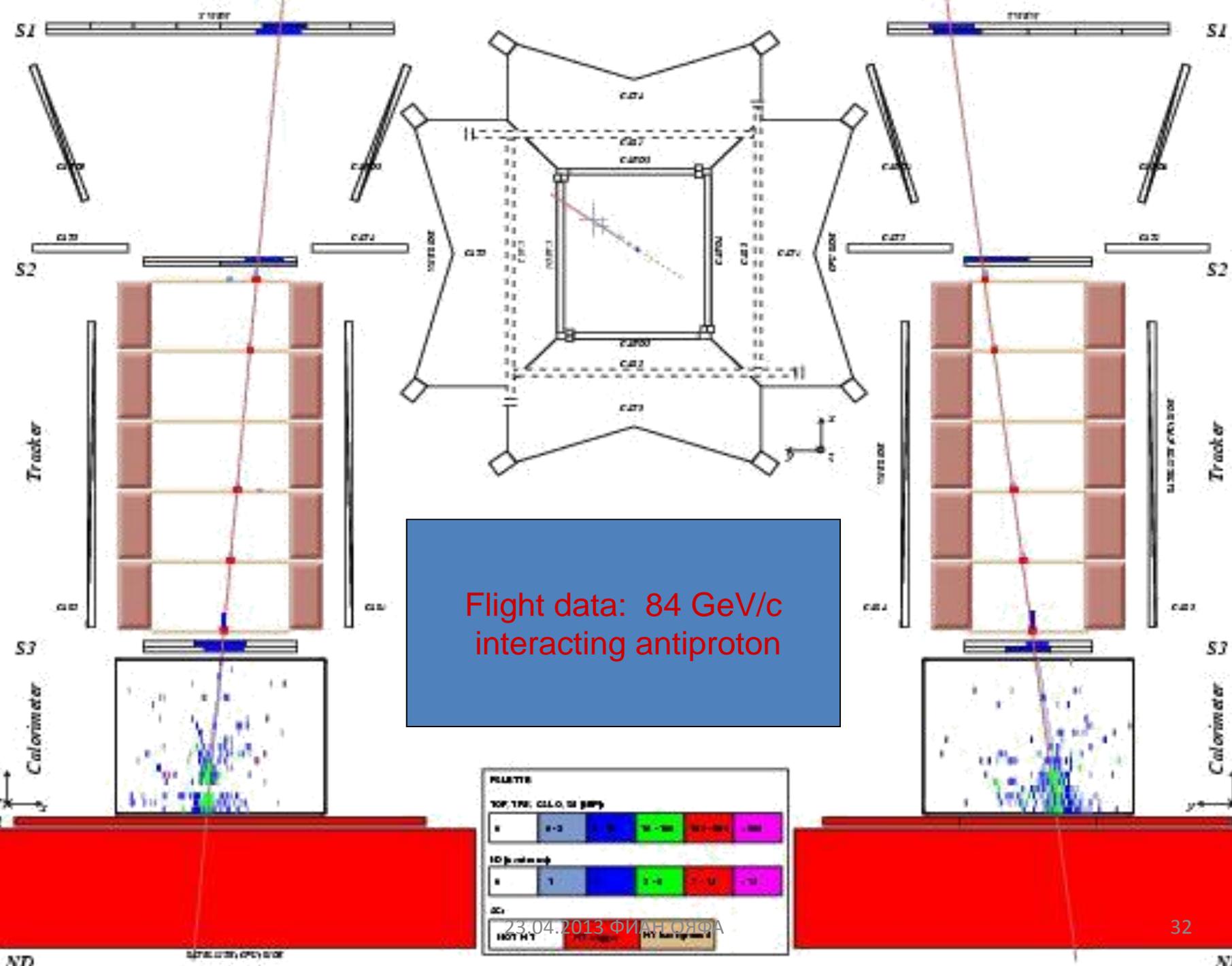
ND [neutrons]:

0	1	2	3-6	7-14	>14
---	---	---	-----	------	-----

AC:

ИОС	ИТ	ИТ	ИТ	ИТ	ИТ
-----	----	----	----	----	----

23.04.2013 ФИАТ ОЯФ



Flight data: 84 GeV/c
interacting antiproton

PILLETTE

TOP, TIME, C.L.O., W. group

8	8-3	9	10-100	11-100	100
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ID to read out

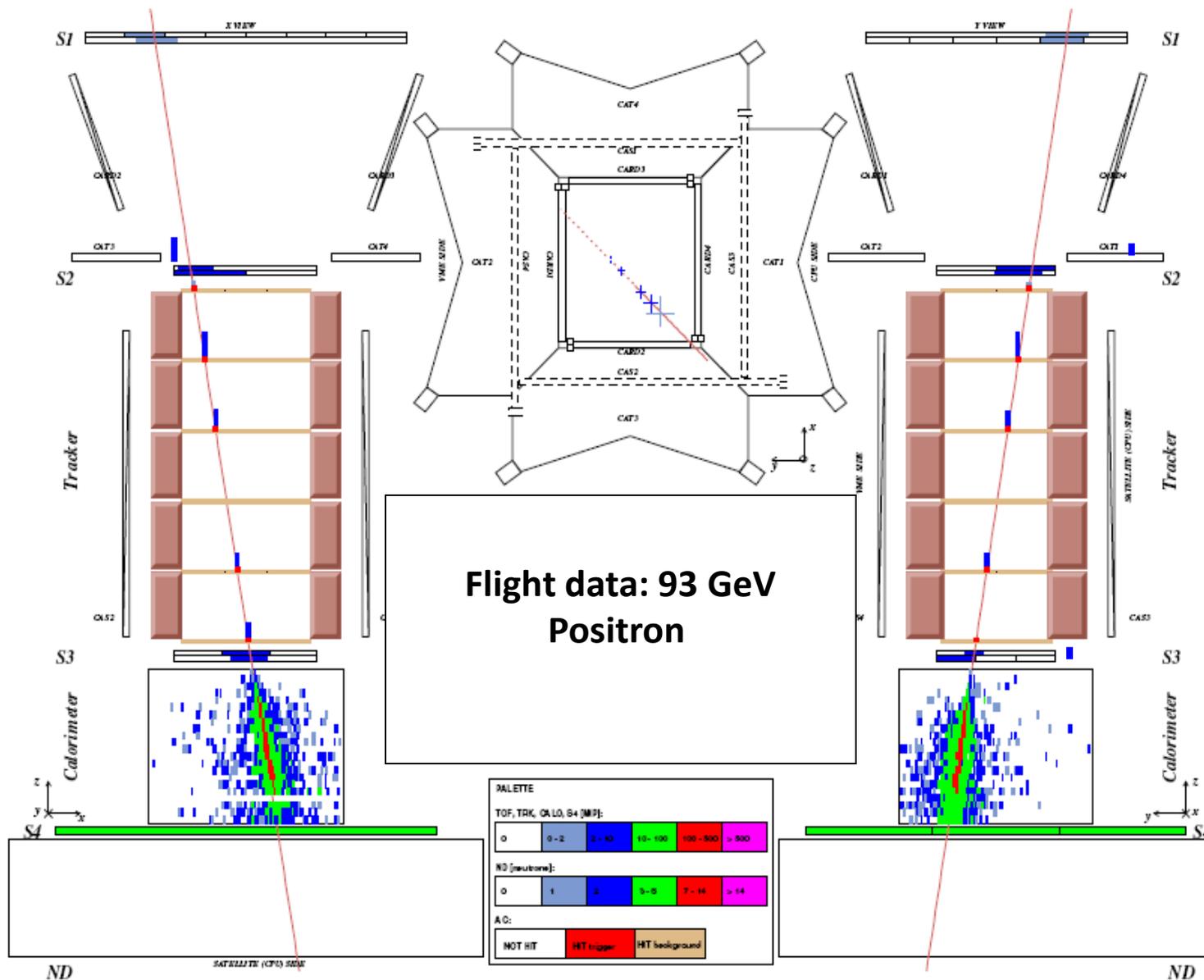
8	1	2-8	9-10	11-10	100
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DC

NOT HT

NY Run program 8

The sample of event



Pamela

senza trucchi

