

AMS

e⁻ e⁻

e⁺

e⁻

e⁻ e⁻

e⁻

e⁻ e⁺

e⁻ e⁻

Interpreting recent e⁺/e⁻ measurements

Timur Delahaye

LAPTh(Annecy) & Univ. Turin



UNIVERSITÀ
DEGLI STUDI
DI TORINO
ALMA UNIVERSITAS
TAURINENSIS



AMS

e⁻ e⁻
e⁻

e⁺

e⁻ e⁻

e⁻ e⁻
e⁻
e⁻

e⁻ e⁺
e⁻ e⁻

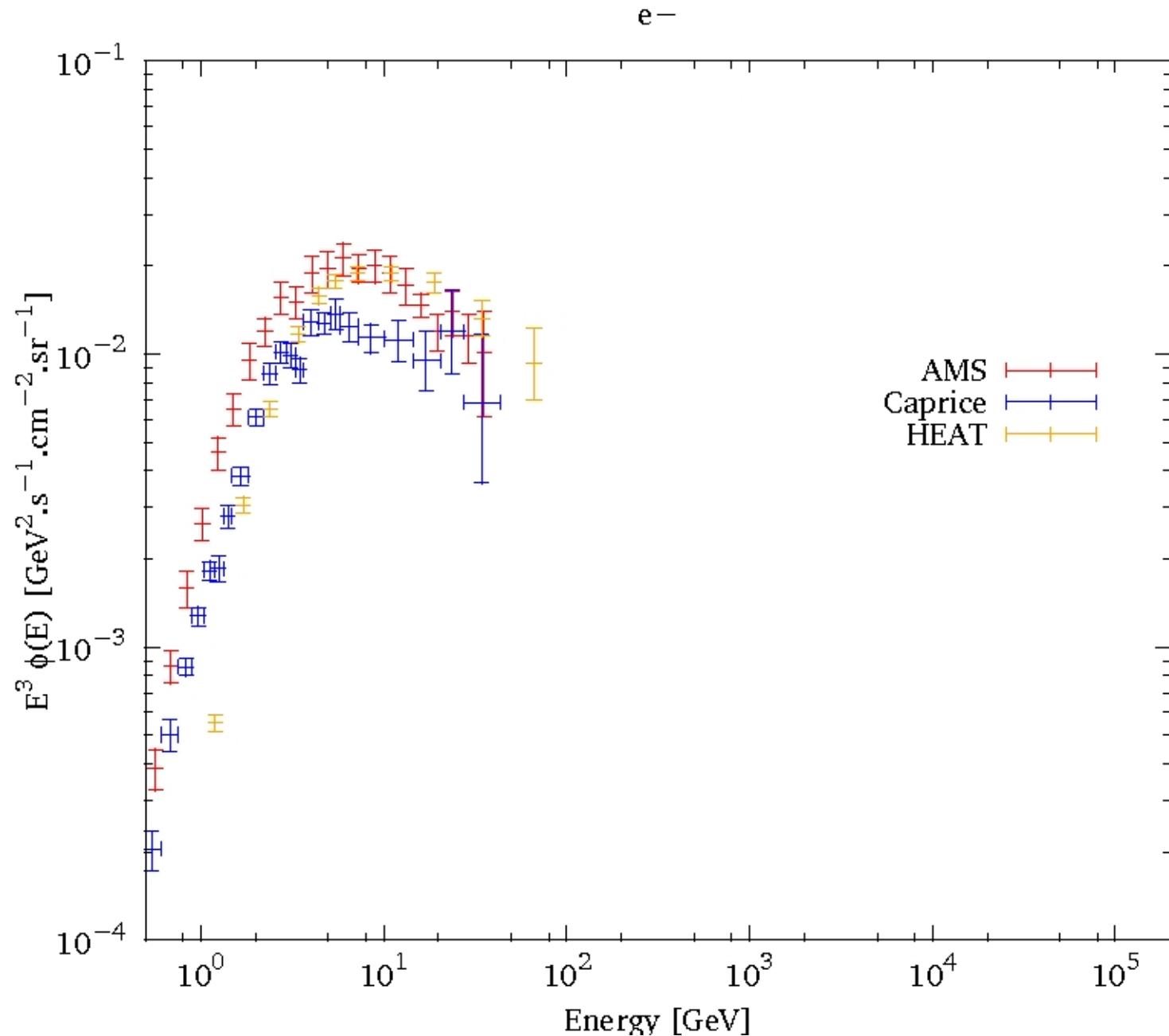
e⁻
e⁻ α
e⁺ e⁻
e⁻ e⁻

Outline

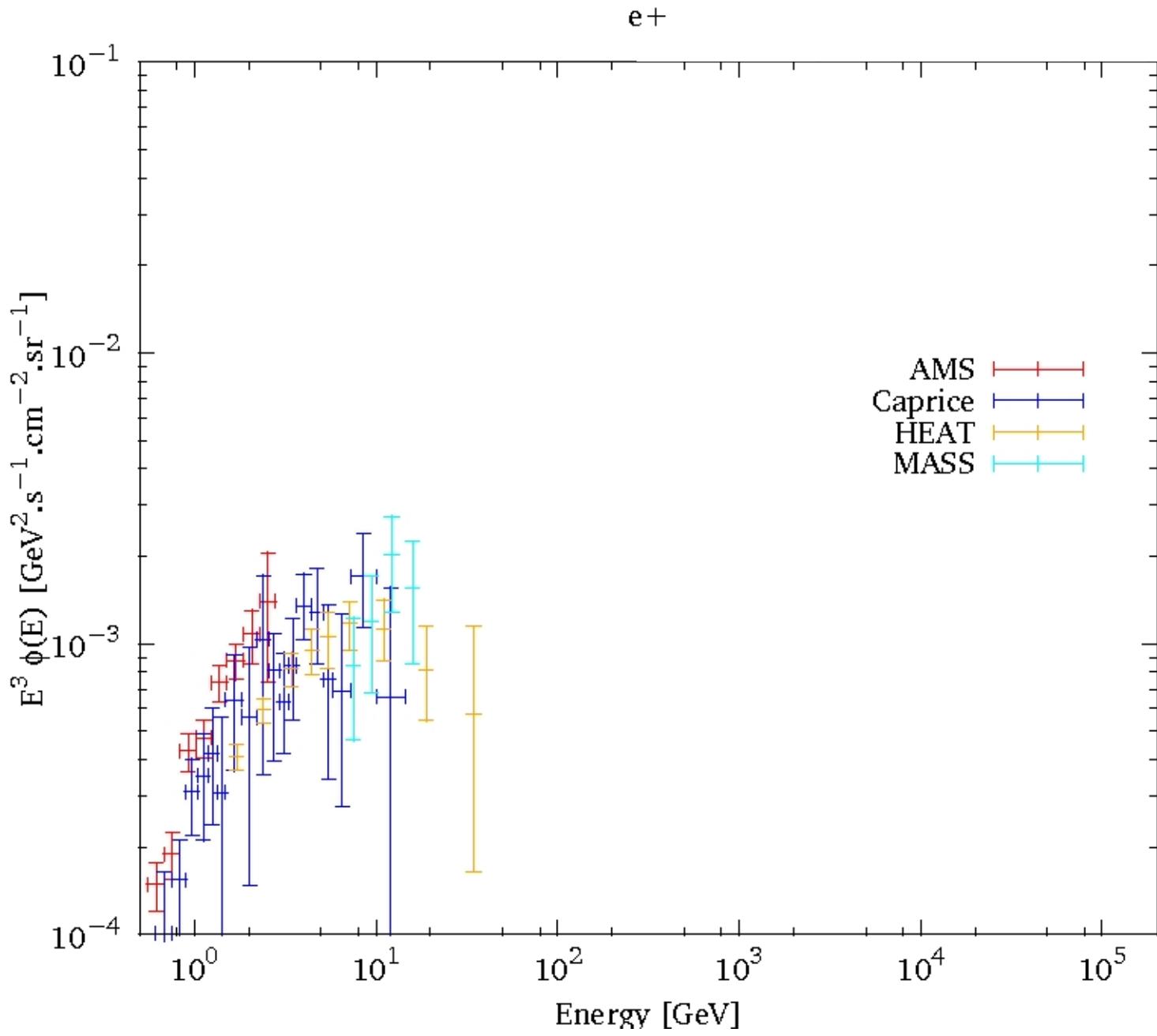
- Present data
- Model
- Secondaries
- Primaries

AMS

e-
e- e-
e-
e+ e-
e- e-
e- e-
e- e-
e- e-
e- e-
e- e+
e- e-
e- e-
e-
e-
e- e-
e- e-
e- χ



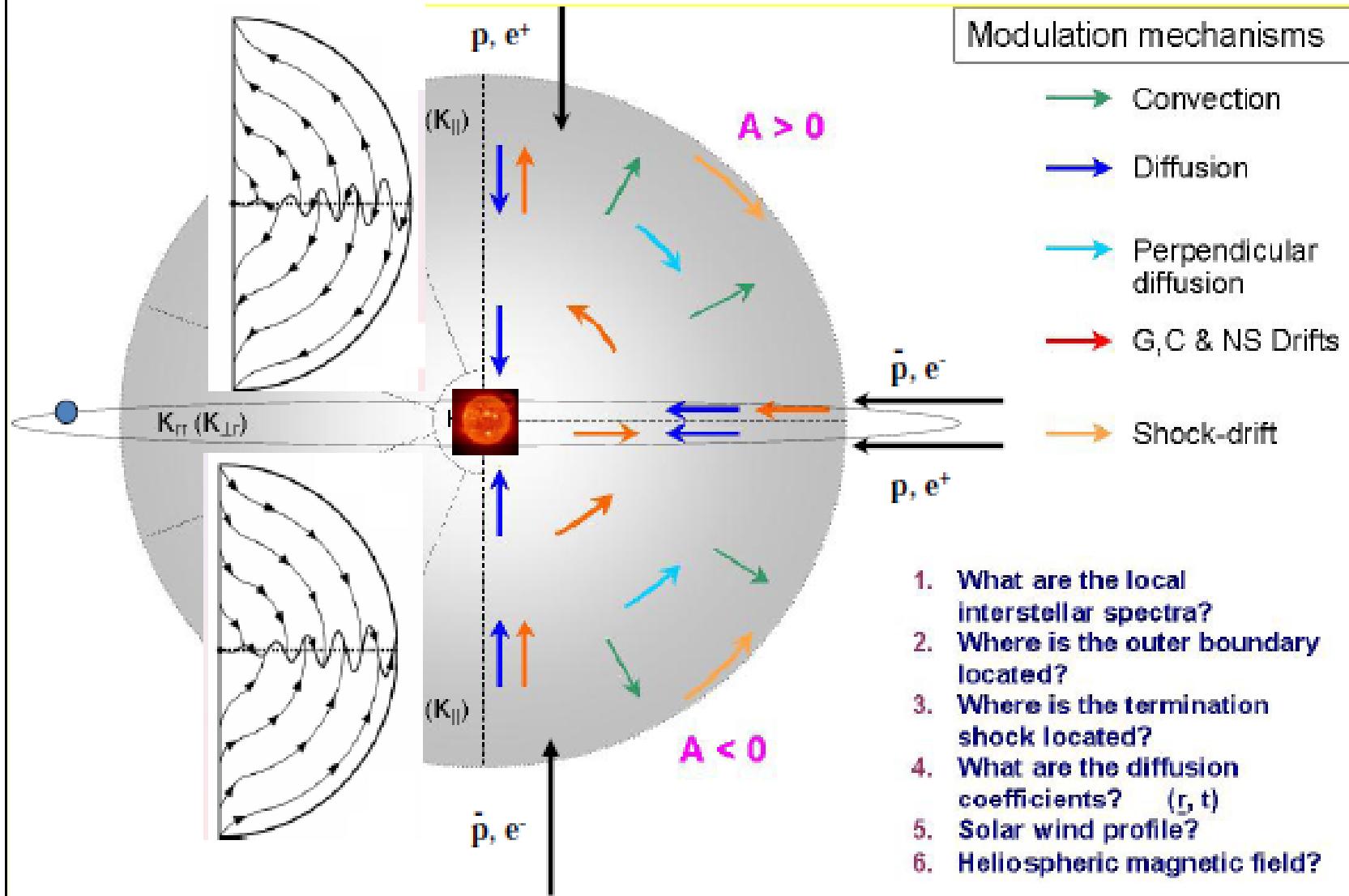
AMS
e- e-
e+ e-
e- e-
e- e-
e- e-
e- e+
e- e-
e- e-
e- χ



Charge dependent solar modulation

AMS

$e^- e^-$
 $e^+ e^-$
 $e^- e^-$
 $e^- e^-$
 $e^- e^- e^+$
 $e^- e^-$
 $e^- e^-$
 $e^- \alpha$
 $e^+ e^- e^-$



1. What are the local interstellar spectra?
 2. Where is the outer boundary located?
 3. Where is the termination shock located?
 4. What are the diffusion coefficients? (ν , t)
 5. Solar wind profile?
 6. Heliospheric magnetic field?

AMS

e- e- e- e-

e+ e- e- e-

e- e- e- e-

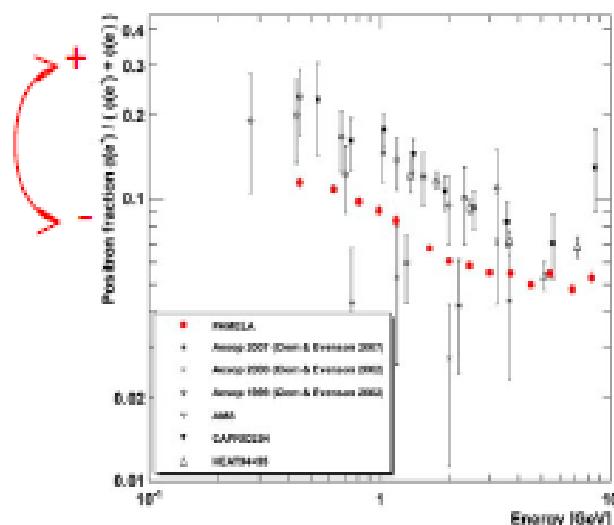
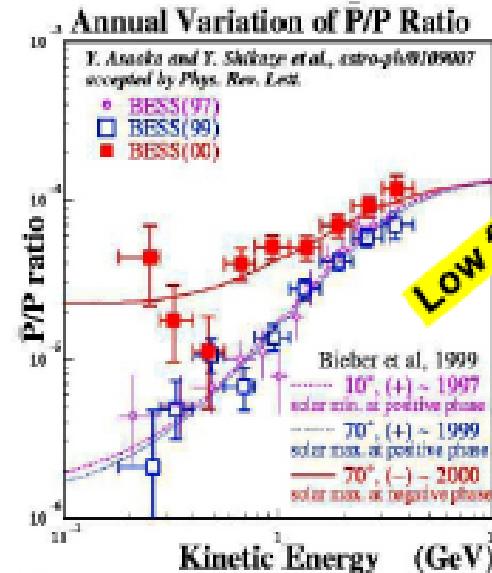
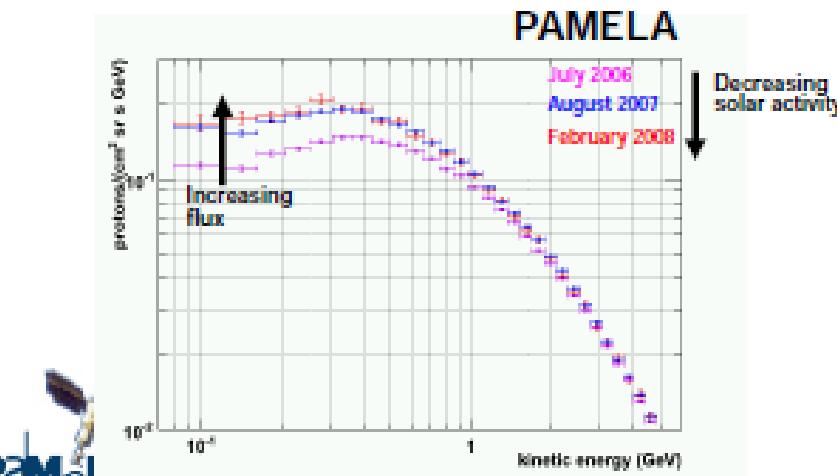
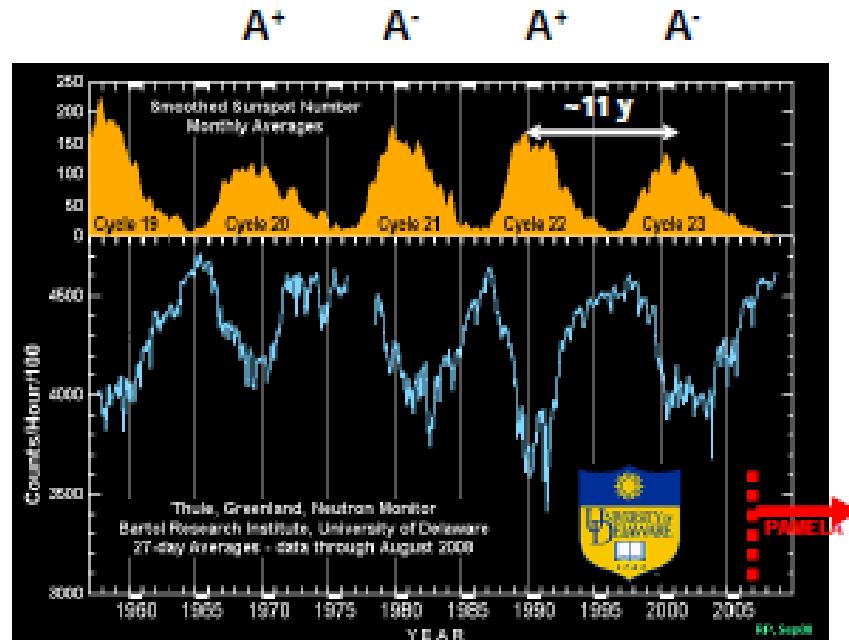
e- e+ e- e-

e- e- e- e-

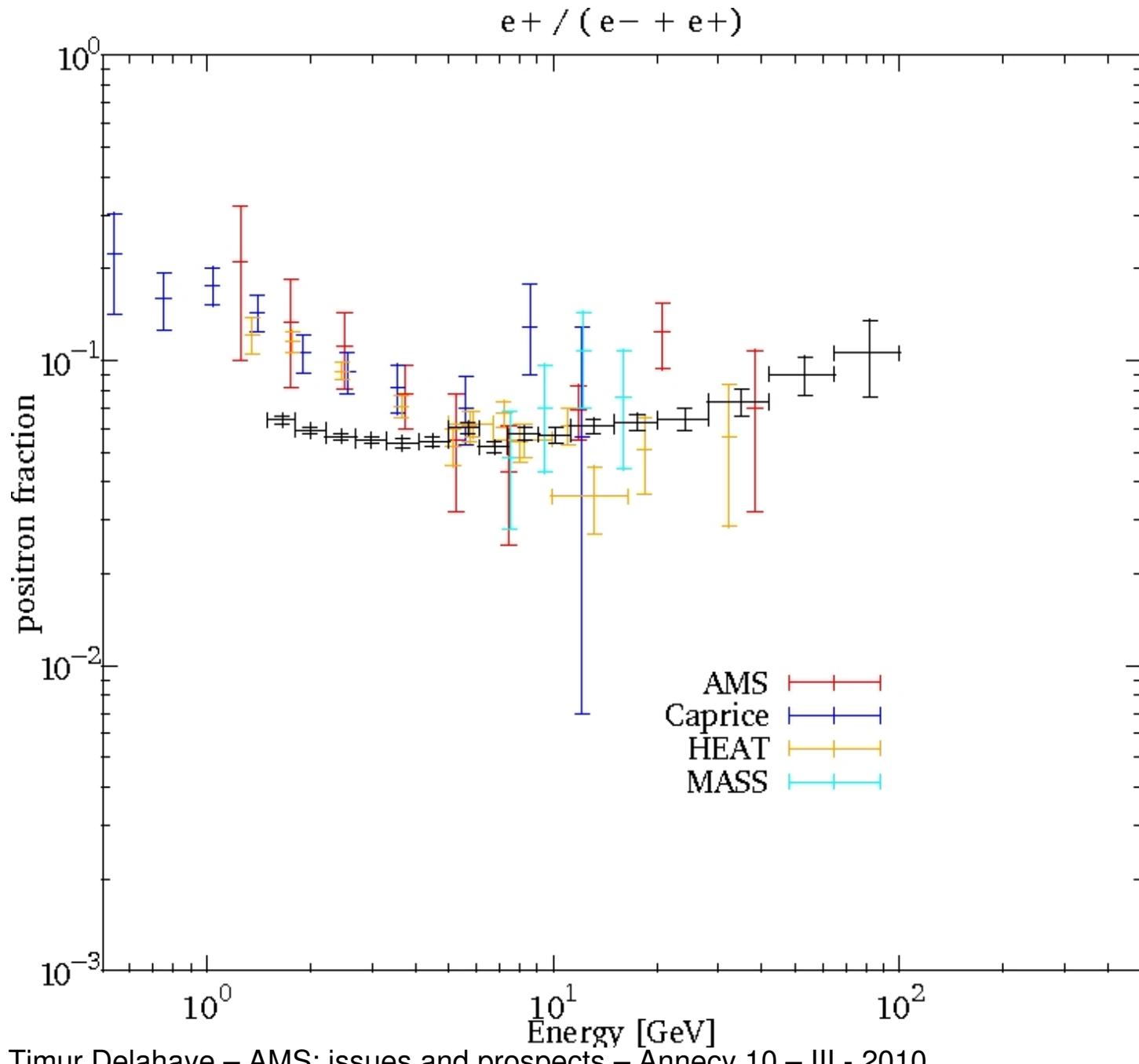
e- α e- e-

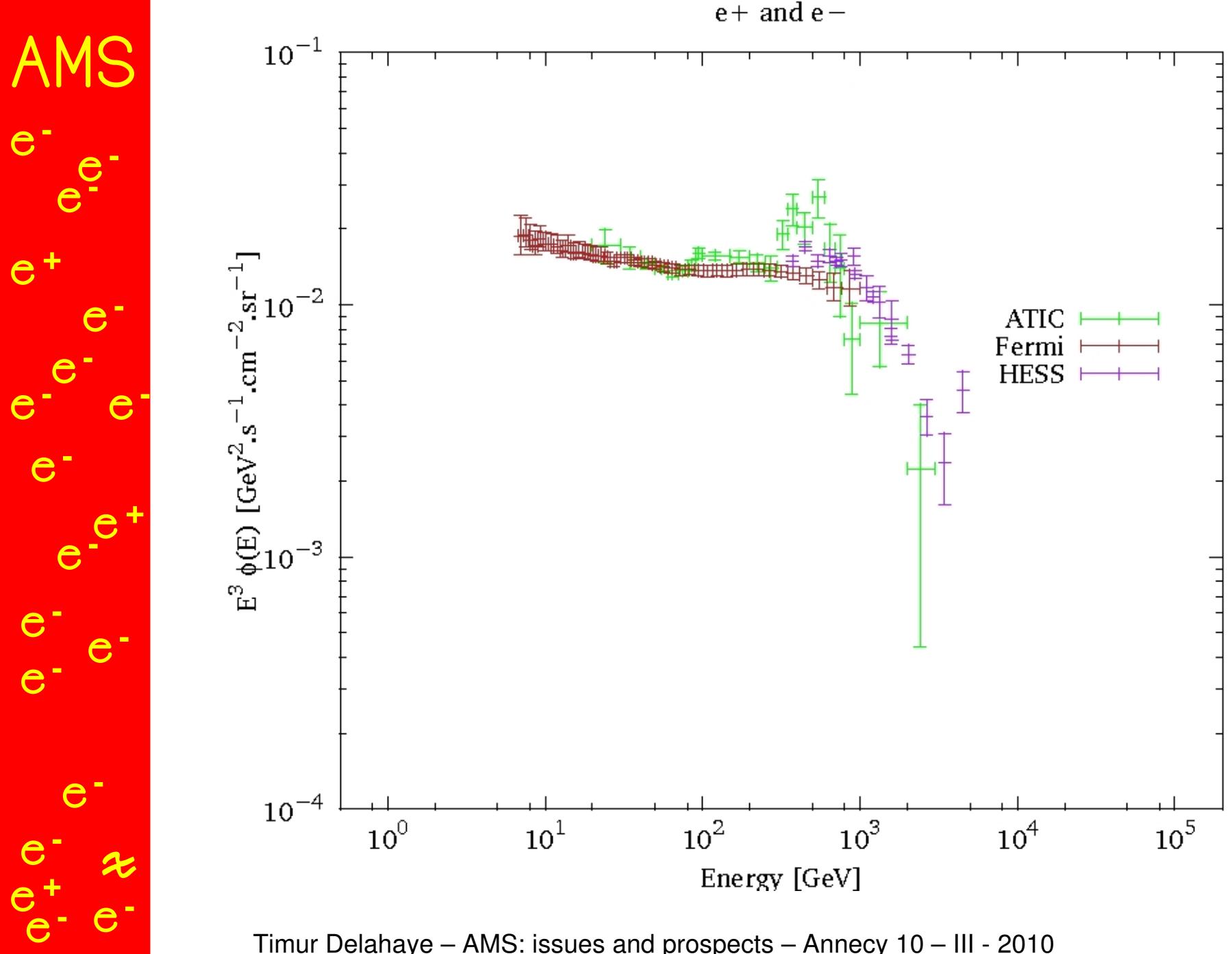
e+ e- e- e-

Solar modulation



AMS
e- e-
e+ e-
e- e-
e- e-
e- e-
e- e+
e- e-
e- χ
e+ e-
e- e-





Model

- Diffusion equation

$$-K_0 E^\delta \Delta \Psi(r, z, E) + \partial_E [b_{loss}(E) \Psi(r, z, E)] = Q(r, z, E)$$

AMS

e⁻ e⁻
e⁻

e⁺

e⁻ e⁻

e⁻ e⁻

e⁻

e⁻ e⁺
e⁻

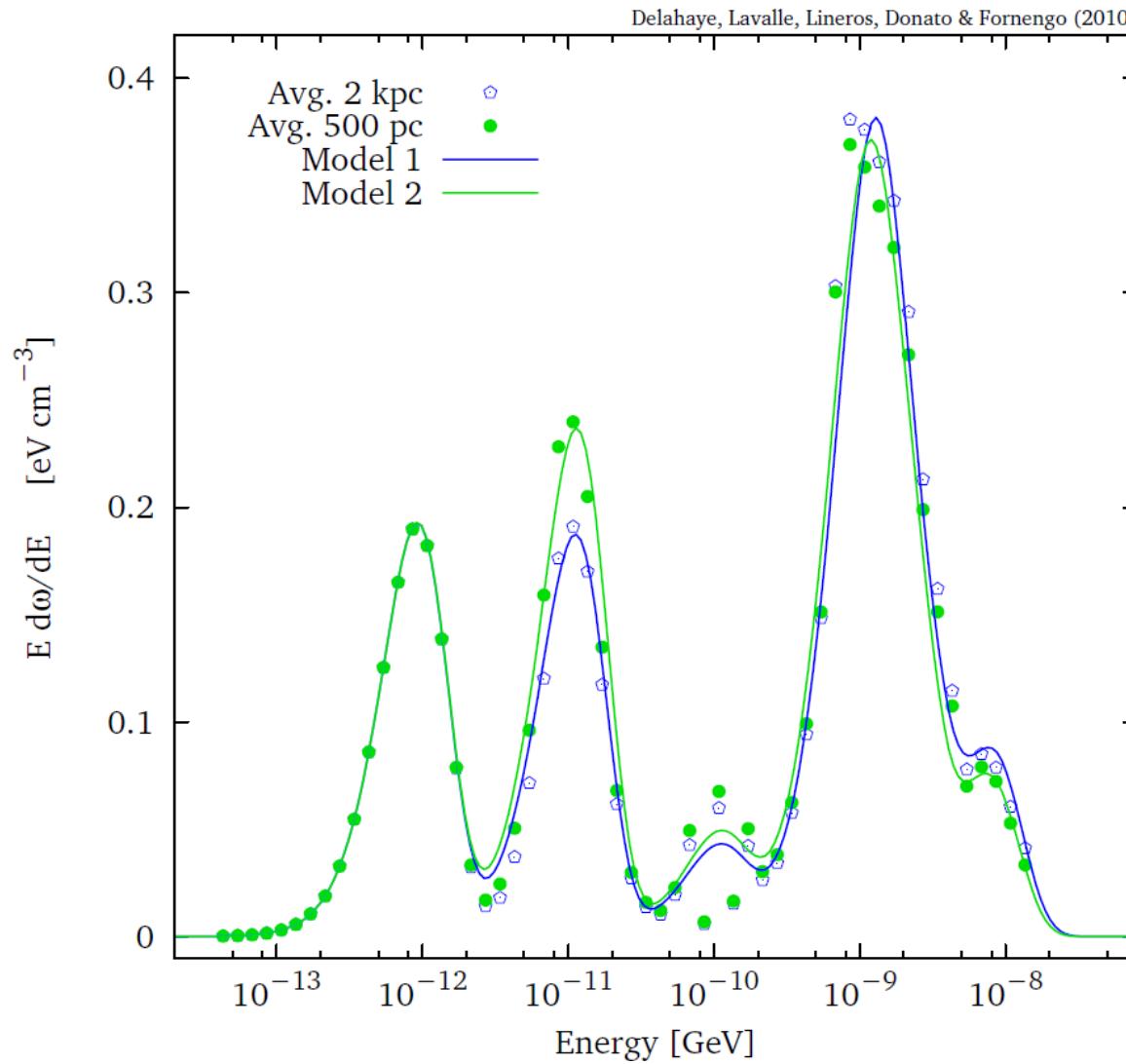
e⁻ e⁻

e⁻

- Adiabatic expansion
- Annihilation
- Ionisation
- Bremsstrahlung
- Synchrotron
- Inverse Compton

AMS

Interstellar Radiation Field



See Porter from
GALPROP

AMS

e⁻ e⁻
e⁻ e⁻

e⁺ e⁻
e⁻ e⁻

e⁻ e⁻
e⁻ e⁻

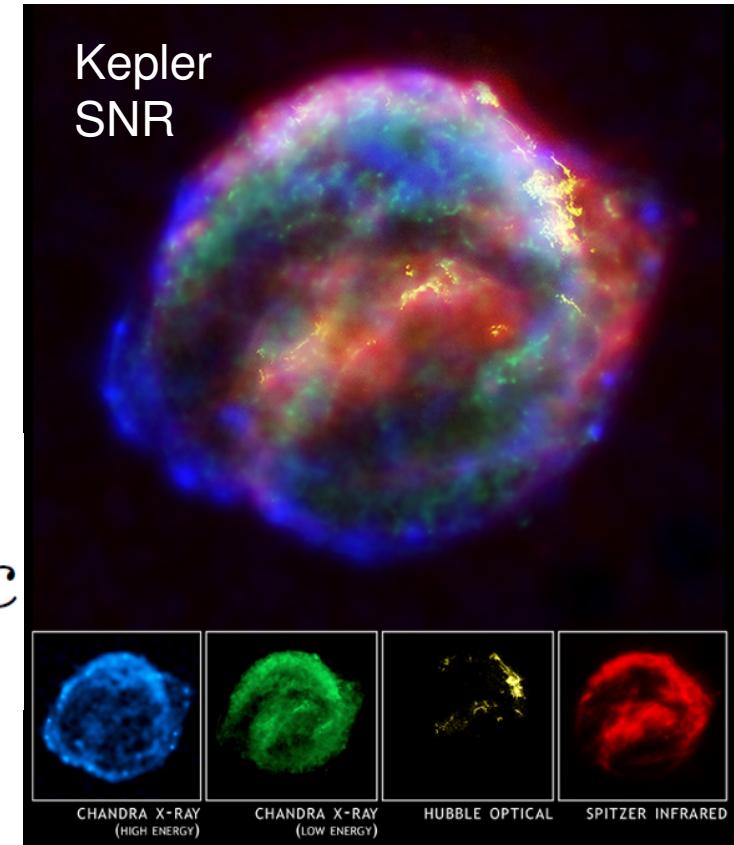
e⁻ e⁺
e⁻ e⁻

$$Q_0 E^{-\gamma} e^{-E/E_c}$$

e⁻
e⁻ α
e⁺ e⁻

Sources

- Supernova remnants



AMS

e⁻ e⁻
e⁻

e⁺ e⁻

e⁻ e⁻

e⁻ e⁻

e⁻ e⁻

e⁻ e⁺

e⁻ e⁻

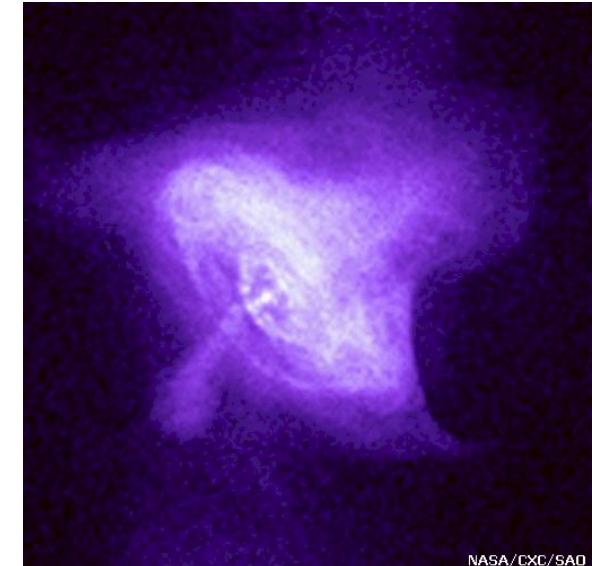
e⁻

e⁻ α

e⁺ e⁻

Sources

- Supernova remnants
- Pulsars



$$Q_0 E^{-\gamma} e^{-E/E_c}$$

AMS

e-
e- e-
e- e- e-

e+
e- e- e-

e- e- e- e-

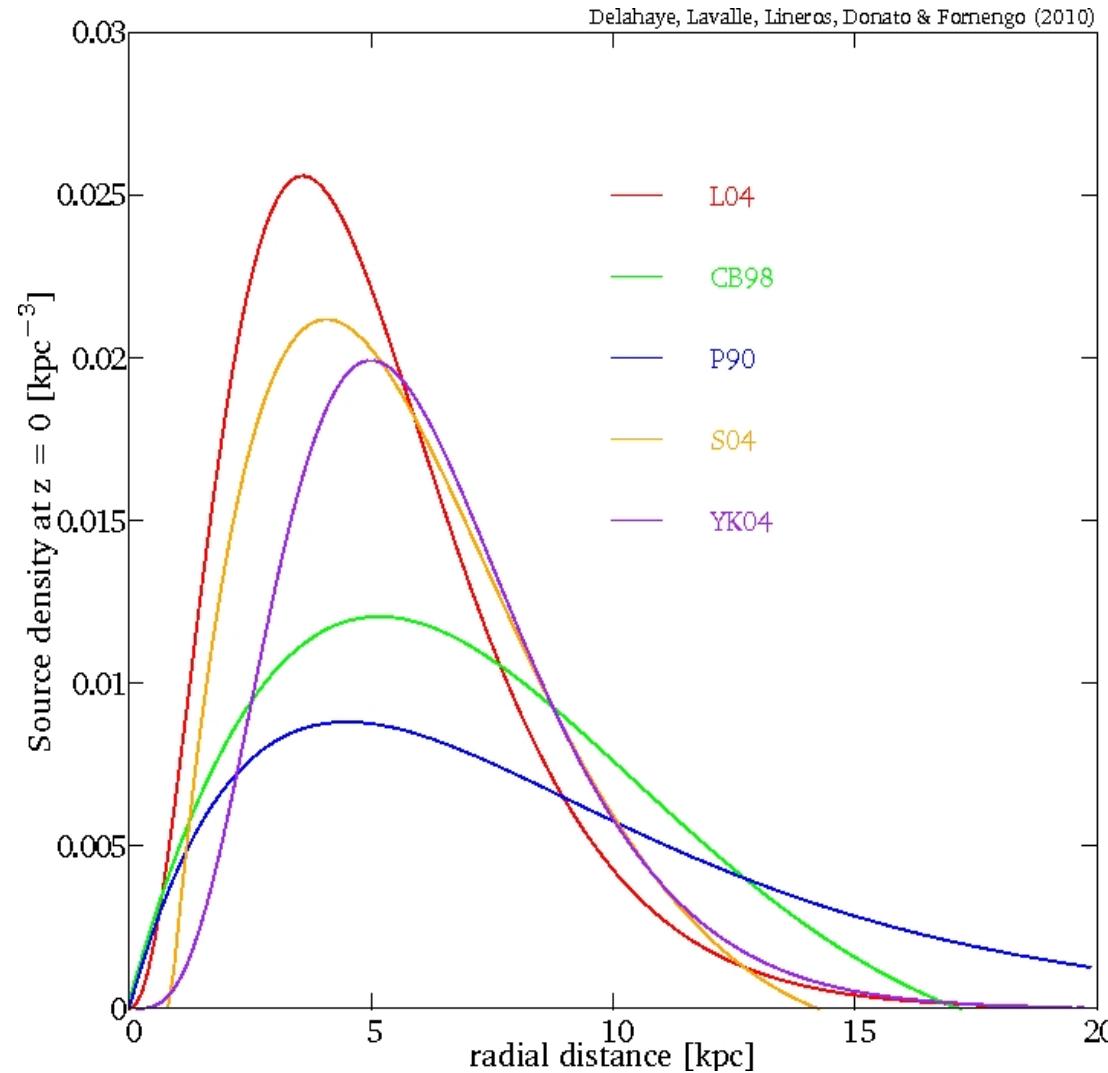
e- e- e- e- e+

e- e- e- e- e- e+

e- e- e- e- e- e- e+

e- e- e- e- e- e- e- e-

Source distribution

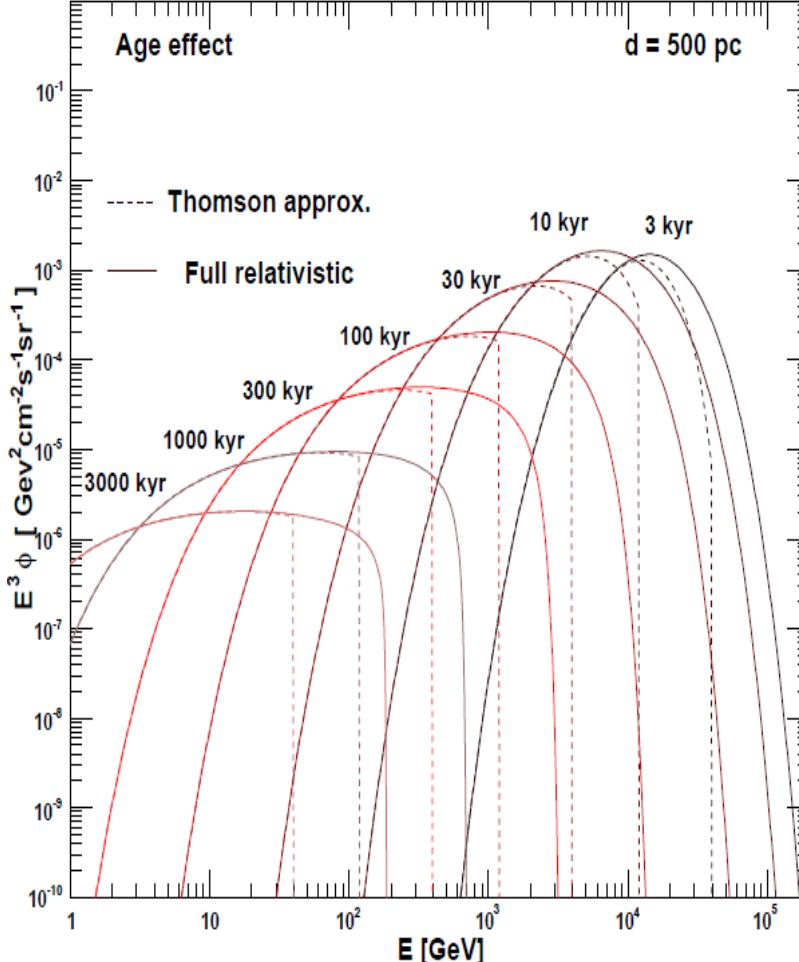


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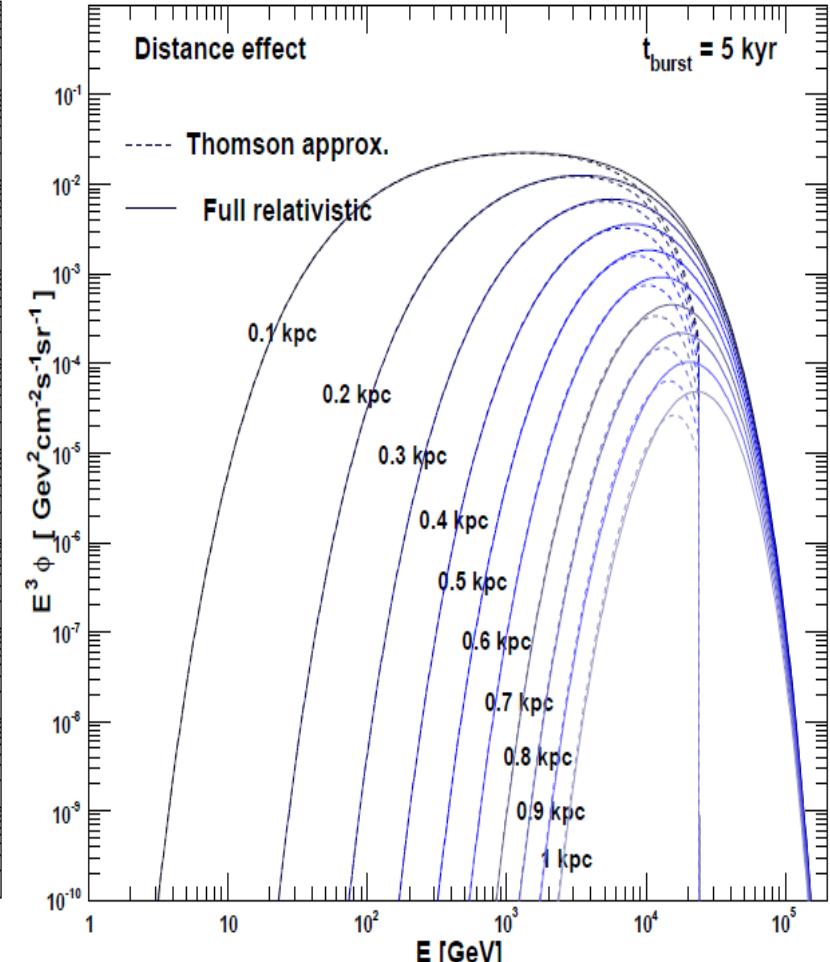
e-
e- e-
e- e- e-e+
e- e-
e- e- e-e-
e- e-
e- e- e-e-
e- e+
e- e- e-e-
e- e-
e- e- e-e+
e- e-
e- e- e-

Discreteness

Delahaye, Lavalle, Lineros, Donato & Fornengo (2010)



Delahaye, Lavalle, Lineros, Donato & Fornengo (2010)

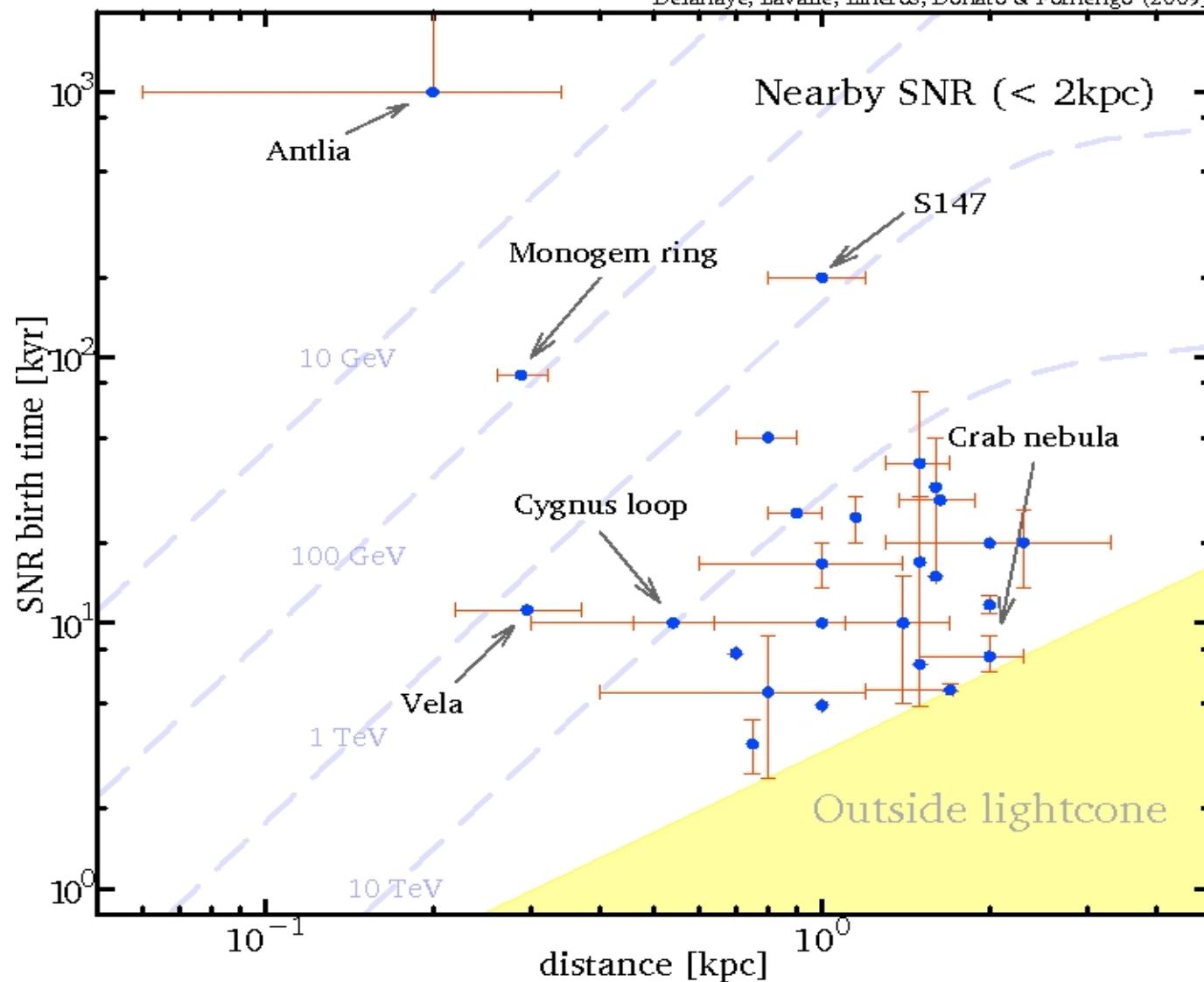


Super Nova Remnant catalogues

- Green catalogue
<http://www.mrao.cam.ac.uk/surveys/snrs/>
 - About 275 known Galactic remnants with coordinates, distance, luminosity at 1GHz, spectral index.
 - Some bibliography provides the age.

Local sources

Delahaye, Lavalle, Lineros, Donato & Fornengo (2009)



AMS

e⁻
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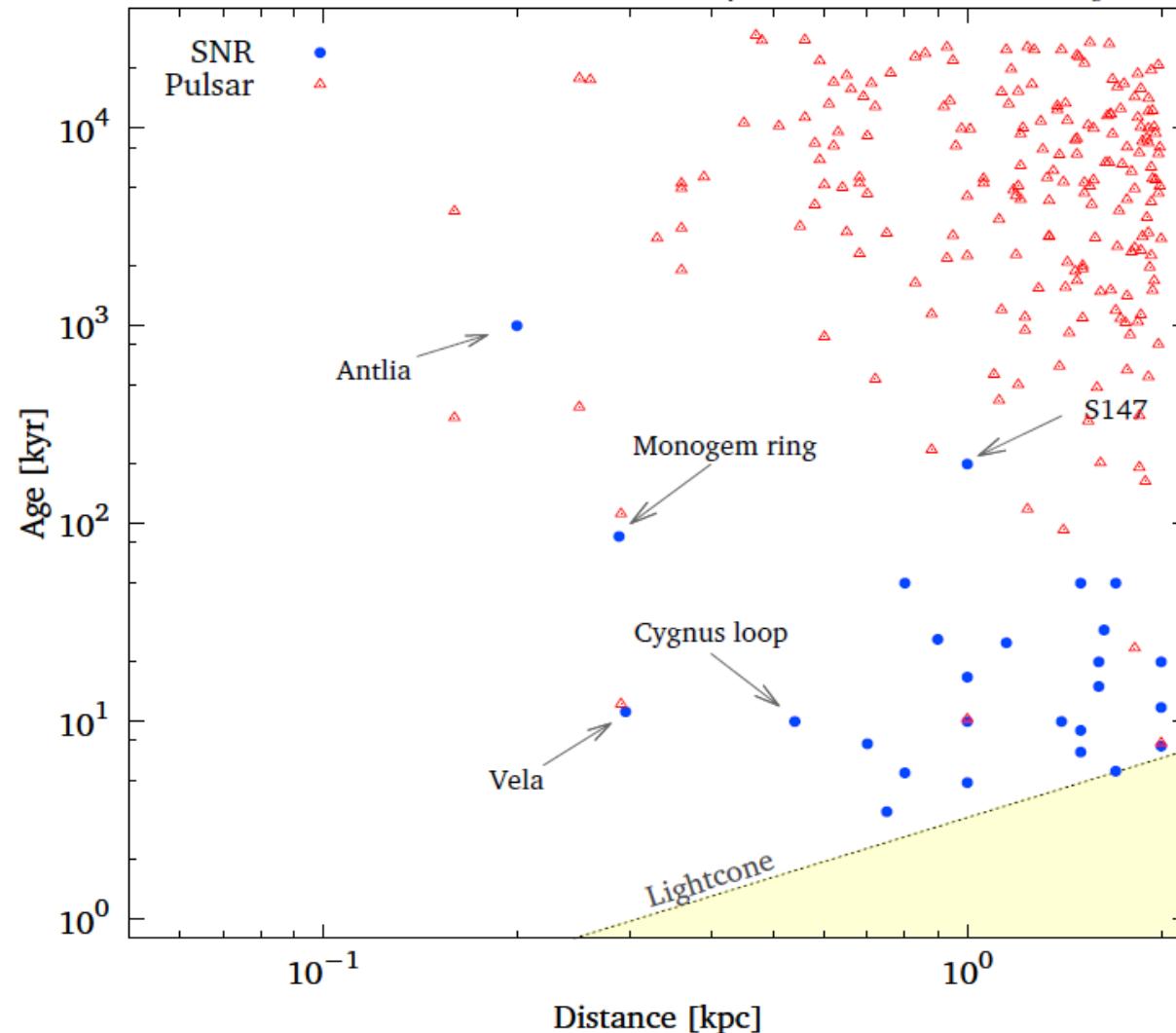
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e⁻

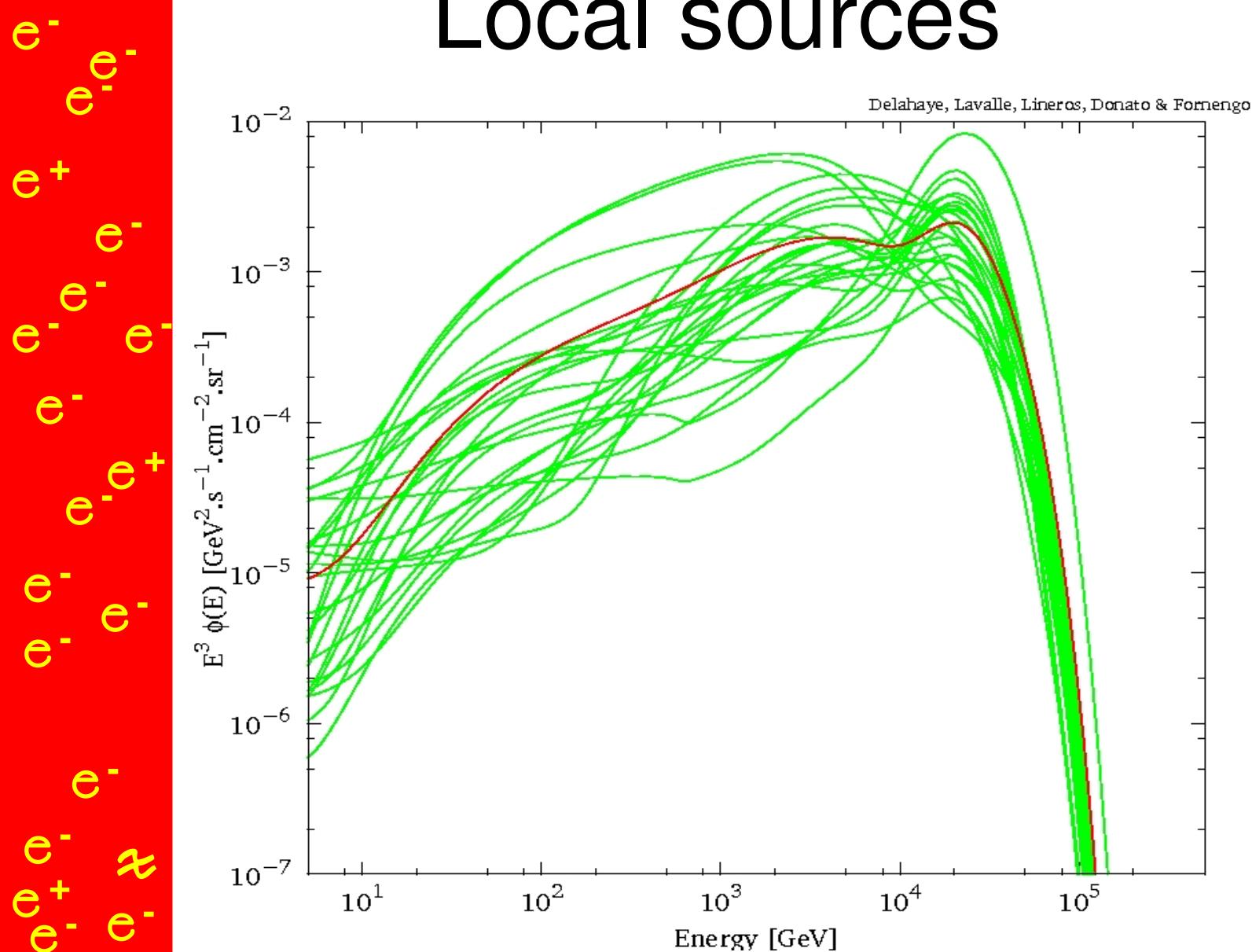
Local sources

Delahaye, Lavalle, Lineros, Donato & Fornengo (2010)



AMS

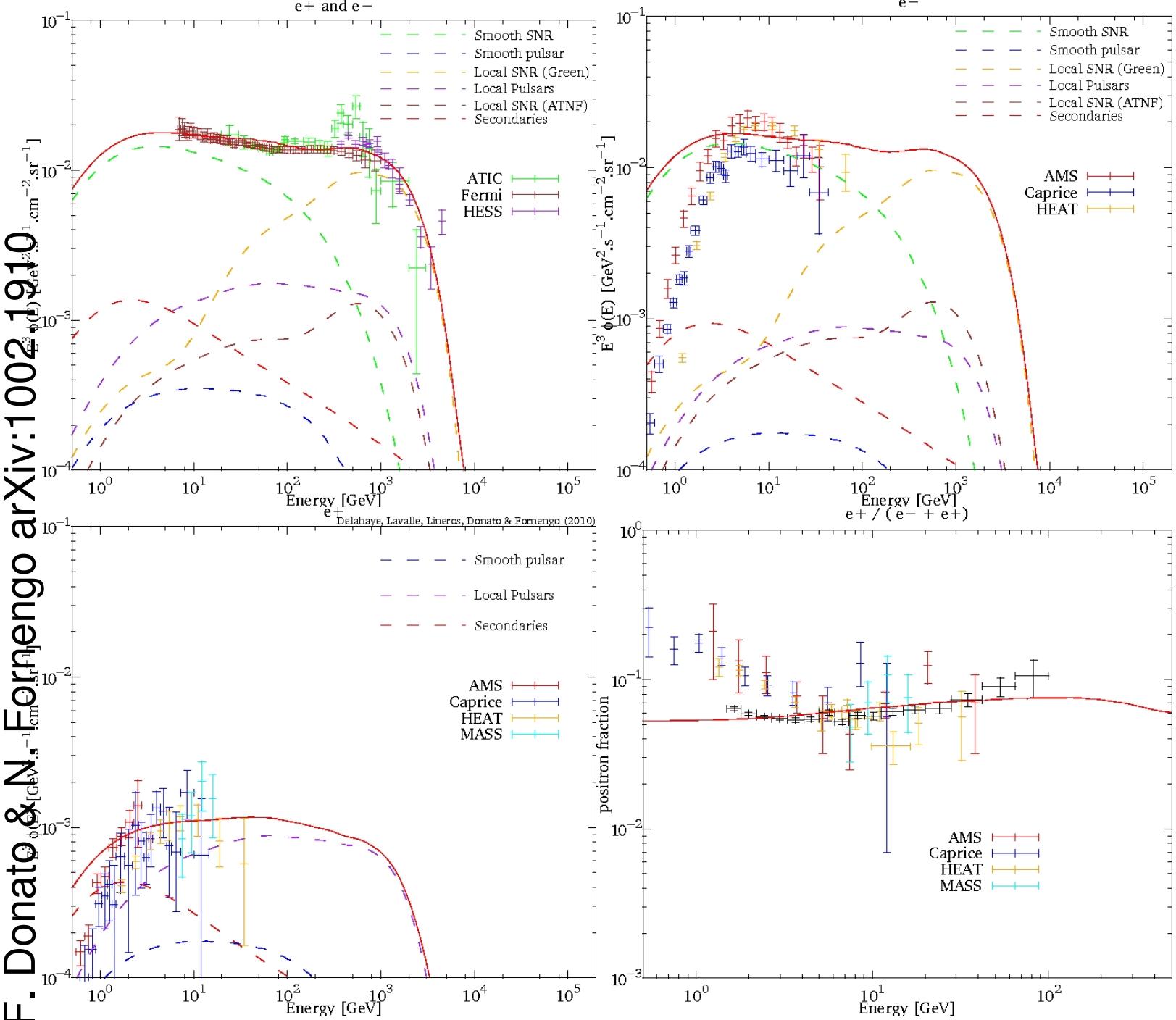
Local sources



AMS
 $e^- e^-$
 $e^+ e^-$
 $e^- e^- e^-$
 $e^- e^-$
 $e^- e^- e^+$
 $e^- e^- e^-$
 e^-
 $e^- \pi$
 $e^+ e^- e^- e^-$

T.D., J. Lavalle, R. Línero,

F. Donato & N. Fornengo at IPN-Orsay



AMS

e⁻ e⁻
e⁻

e⁺

e⁻ e⁻

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e⁻ e⁺
e⁻

e⁻ e⁻

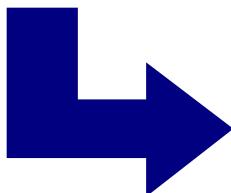
e⁻
e⁻ α
e⁺
e⁻ e⁻

Open questions

- Secondary production in SNRs

Blasi & Serpico (PRL103, 2009)

Mertsch, Ahlers & Sarkar (PRD80 & PRL103, 2009)



anti-protons & B/C

AMS

e⁻
e⁻e⁻
e⁻e⁻e⁻

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e⁻e⁻e⁻

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e⁻e⁻e⁻

e⁻e⁻e⁻

e⁻e⁻e⁻

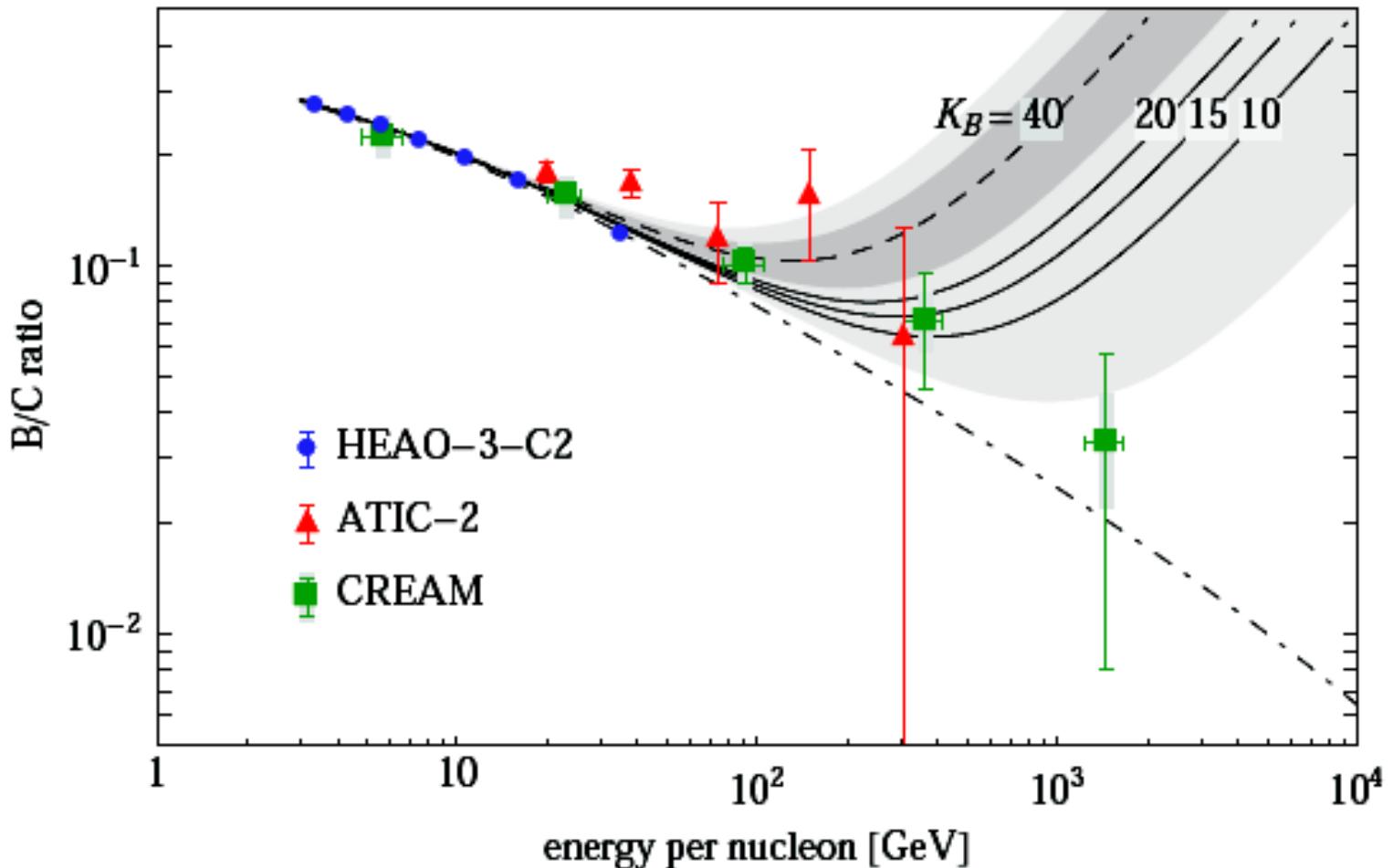
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Open questions



Ahlers, Mertsch & Sarkar PRD 80, 2009

AMS

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e⁻ e⁻

e⁻ e⁻

e⁻

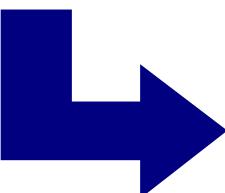
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e⁻ e⁻

e⁻
e⁻ α
e⁺ e⁻ e⁻

Open questions

- Fermi features
 - Expected (local astrophysical sources)
 - Dark Matter



positron absolute spectra

AMS

e⁻ e⁻
e⁻

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e⁻ e⁺
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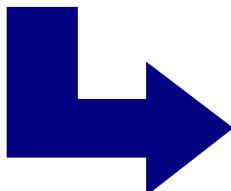
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e⁻

e⁻ α
e⁺ e⁻ e⁻

Open questions

- HESS feature
 - Absolute cut-off
 - One cut-off among many
 - Dark Matter



Very high energy data
(CALET ? CTA !)

AMS

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e⁻

e⁺

e⁻ e⁻

e⁻ e⁻

e⁻

e⁻ e⁺

e⁻ e⁻

e⁻
e⁻ χ
e⁺ e⁻ e⁻

More data will be
welcome !