PROSPECTS FOR THE DETECTION OF ELECTRON HALOS OF MIDDLE-AGE PULSARS

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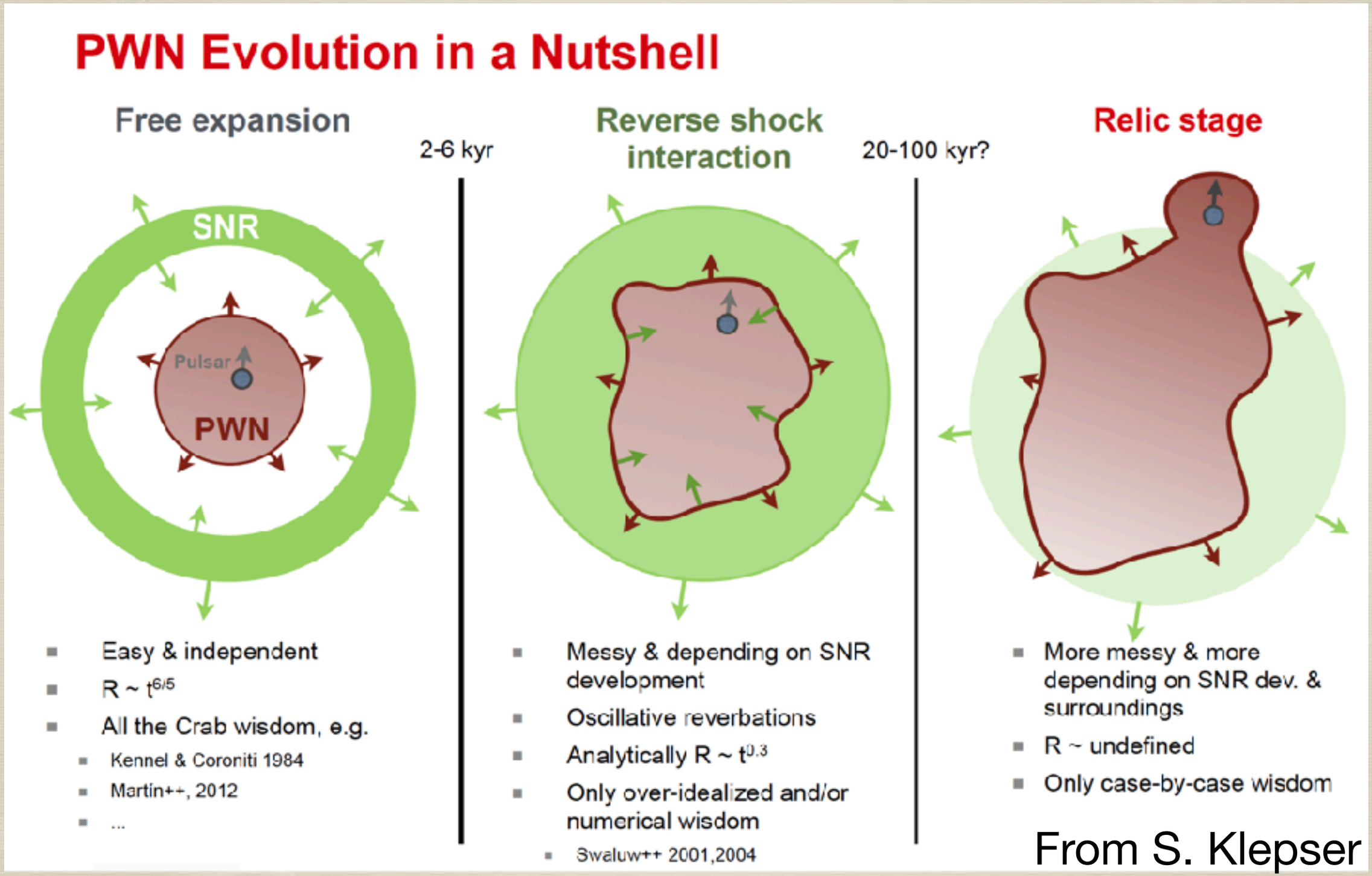
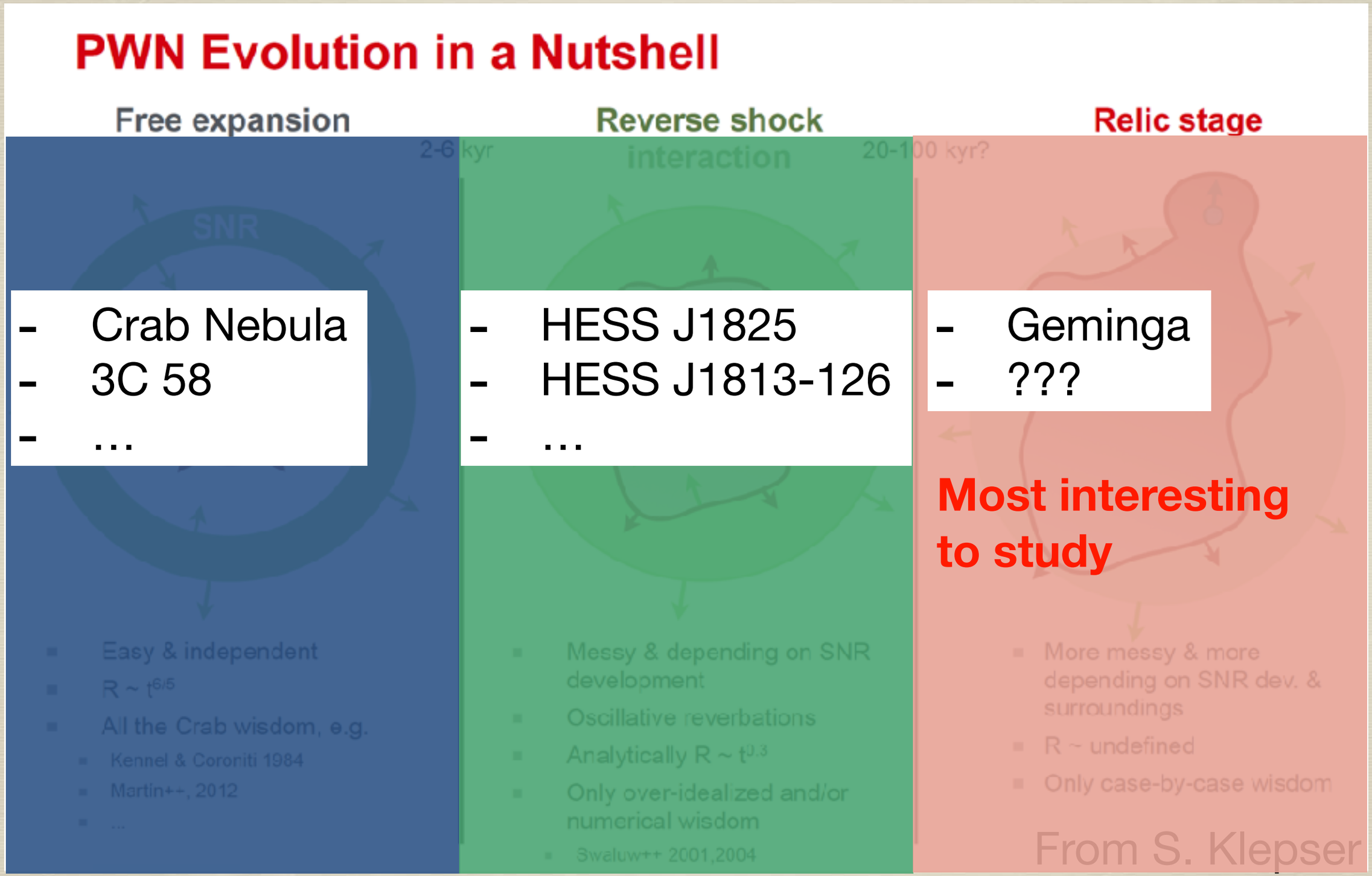
SGSO Workshop - Buenos Aires - 11/12/17

PULSAR WIND NEBULAE



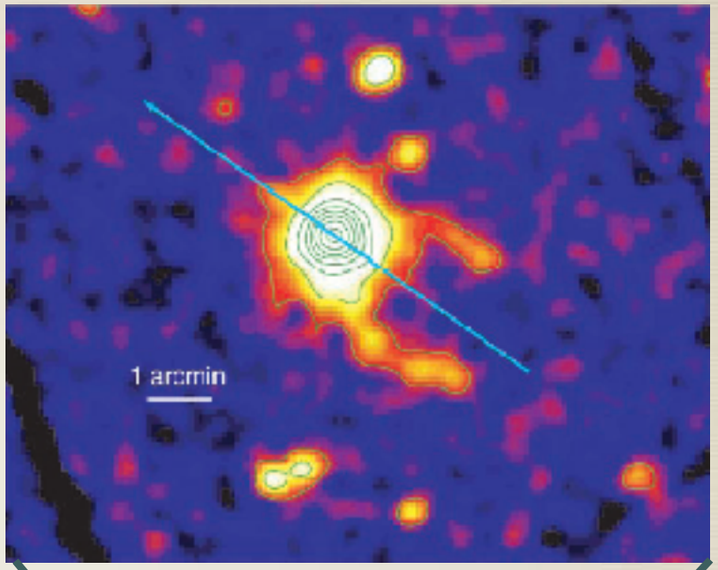
From S. Klepser

PULSAR WIND NEBULAE

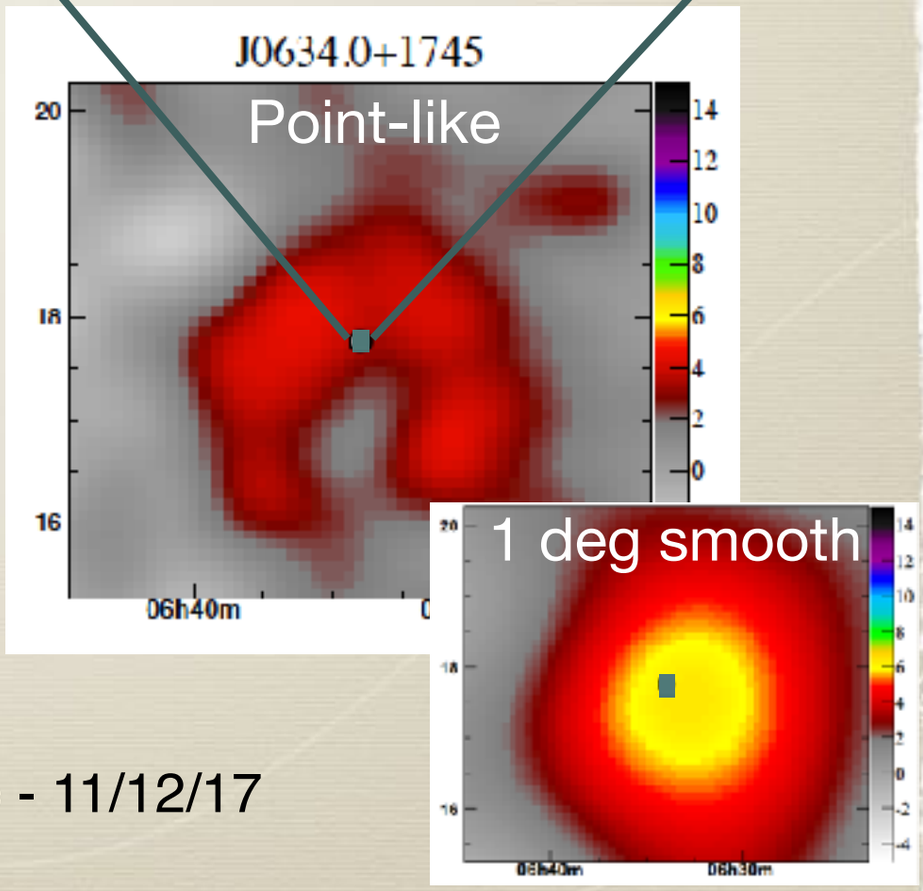


“RELIC” PWNe

- Geminga is a middle-age (~300 kyr) and near (~250 pc) pulsar
- First pulsar discovered in GeV gamma rays and second strongest persistent source at GeV energies.
- In **X-rays**, the PWN has a bow-shock shape with an ~arcmin size



- At **TeV gamma rays**, Milagro reported excesses from the region.
- HAWC detected it with a ~5 deg extension, together



The PWN? in Geminga

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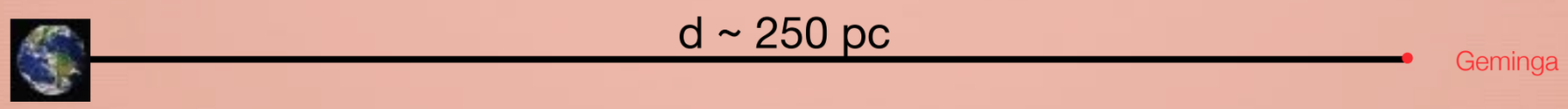
ε_{ISM}~2-3 eV/cm^3



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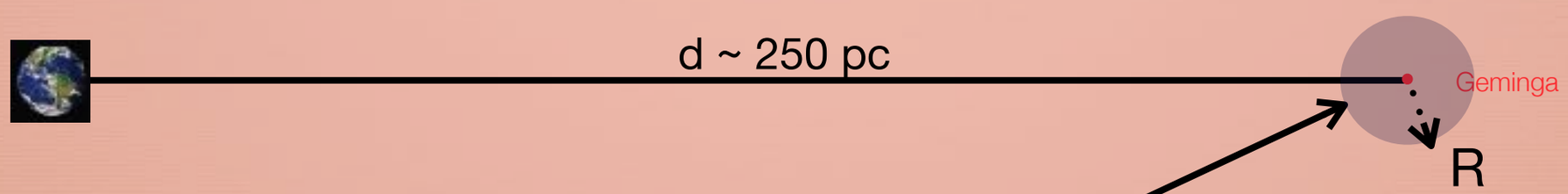
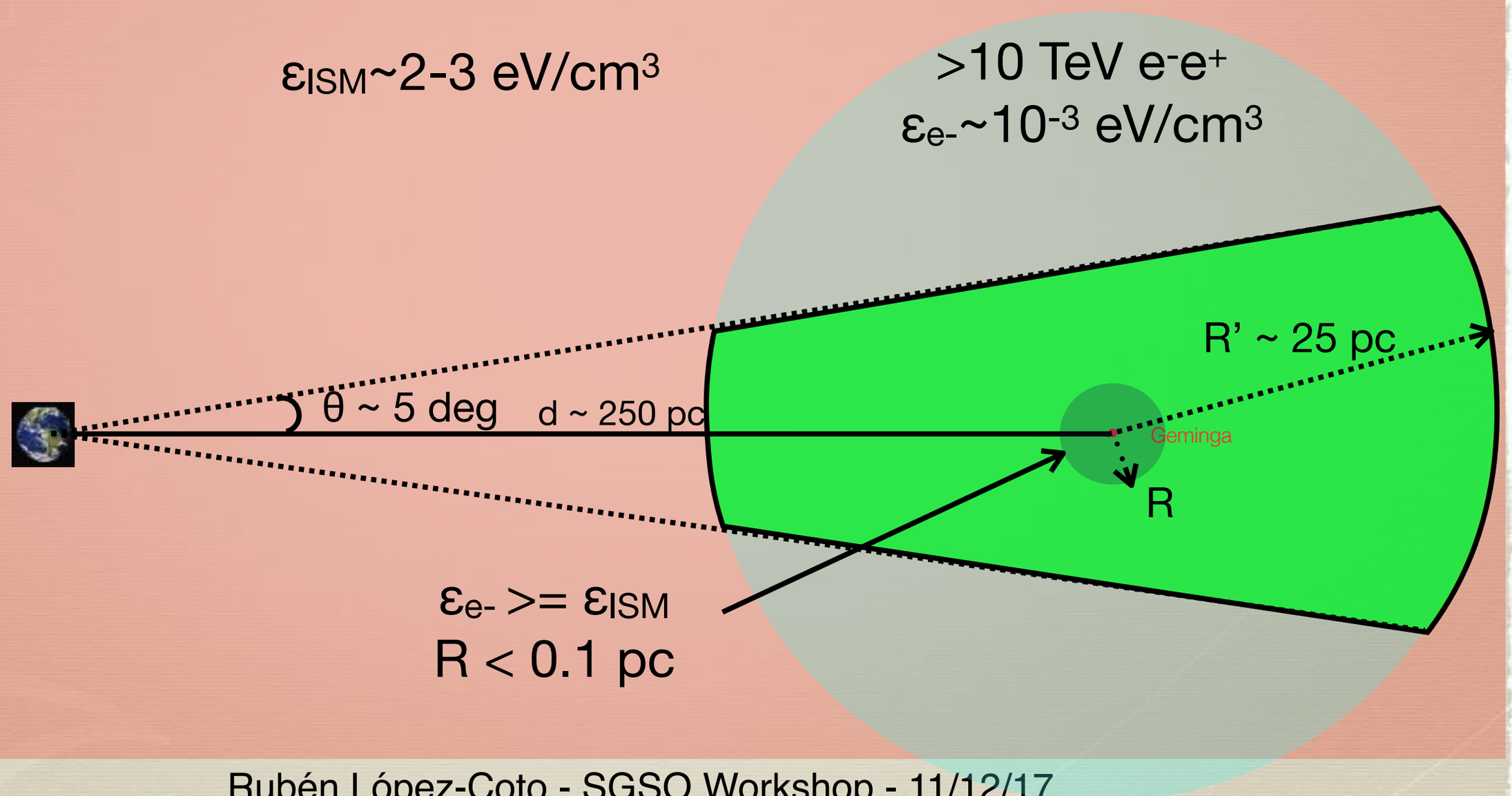


$\varepsilon_{e-} >= \varepsilon_{ISM}$

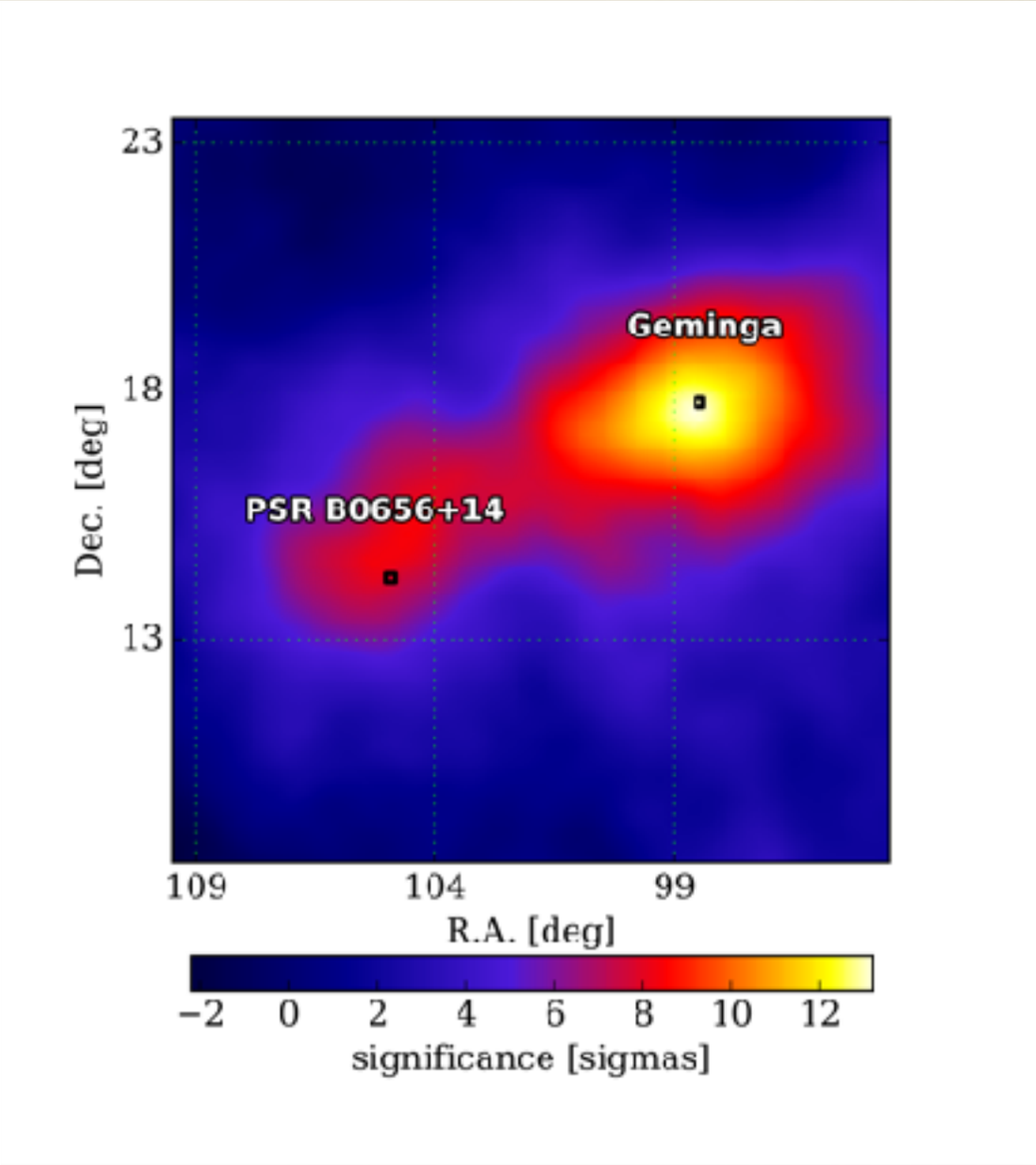
R < 0.1 pc

The “Electron halo” in Geminga



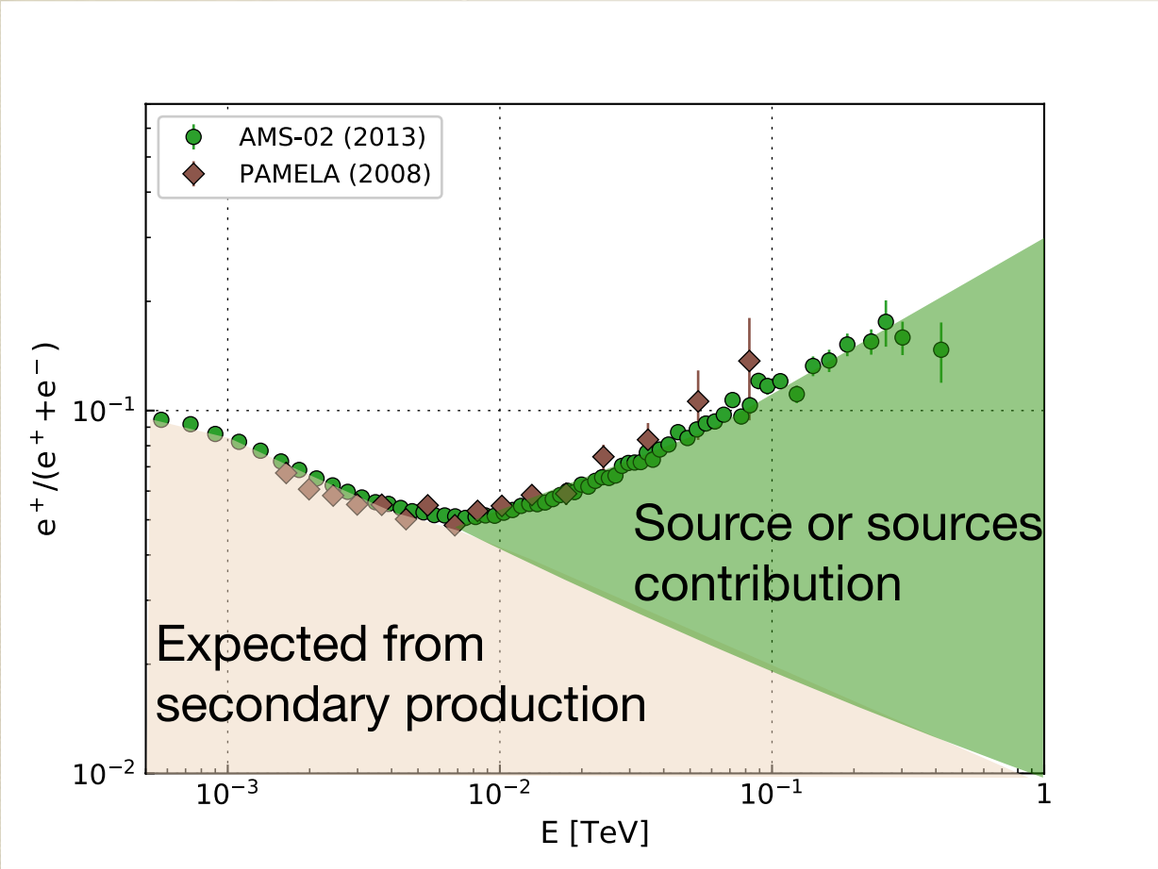
Geminga by HAWC

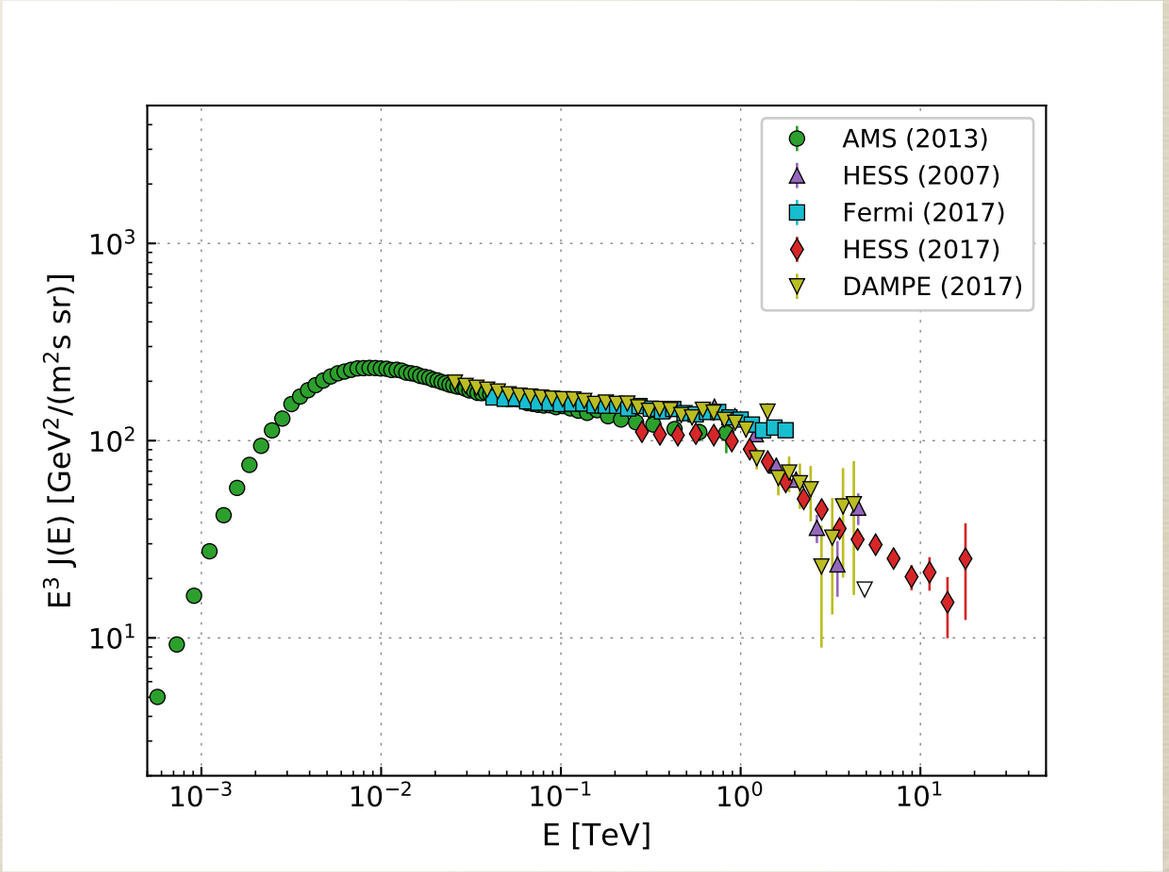
- Detection of two very extended gamma-ray sources coincident with Geminga and PSR B0656+14 with ~5 deg extension
- Measured the gamma-ray spectrum between 8 and 40 TeV
- Constraint on the diffusion coefficient of the ISM
- Constraint on the contribution of these two pulsars to the positron flux at the Earth.
- Not done by HAWC: energy dependent morphology
- Paper published in Science



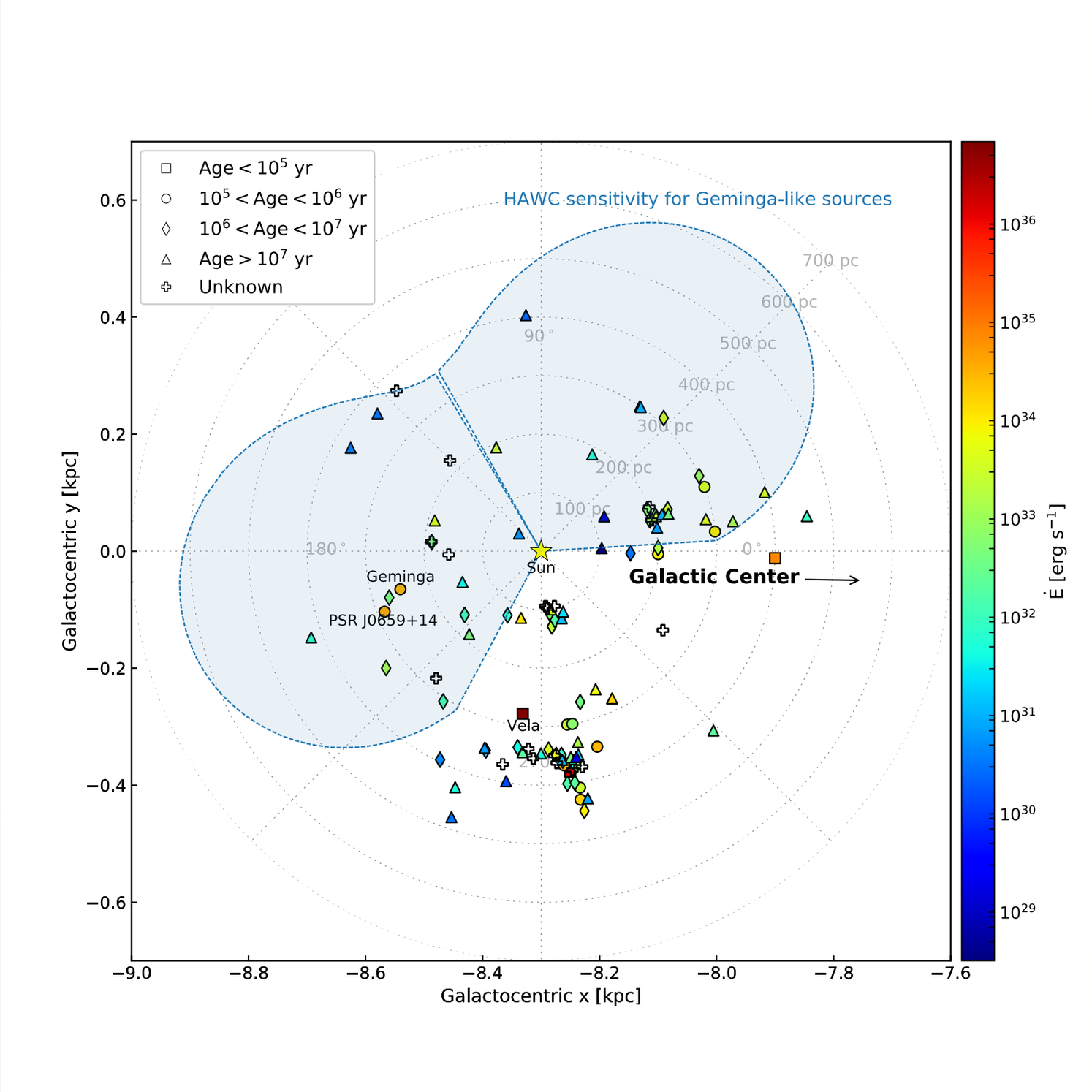
All-electron and positron fraction

- The positron fraction is expected to decrease with Energy
  - This is the case for energies below a few GeV
- At higher energies the positron fraction increases -> There has to be a source injecting them
- The all-electron spectrum recently measured by HESS reaches ~15 TeV
  - They have to be local!

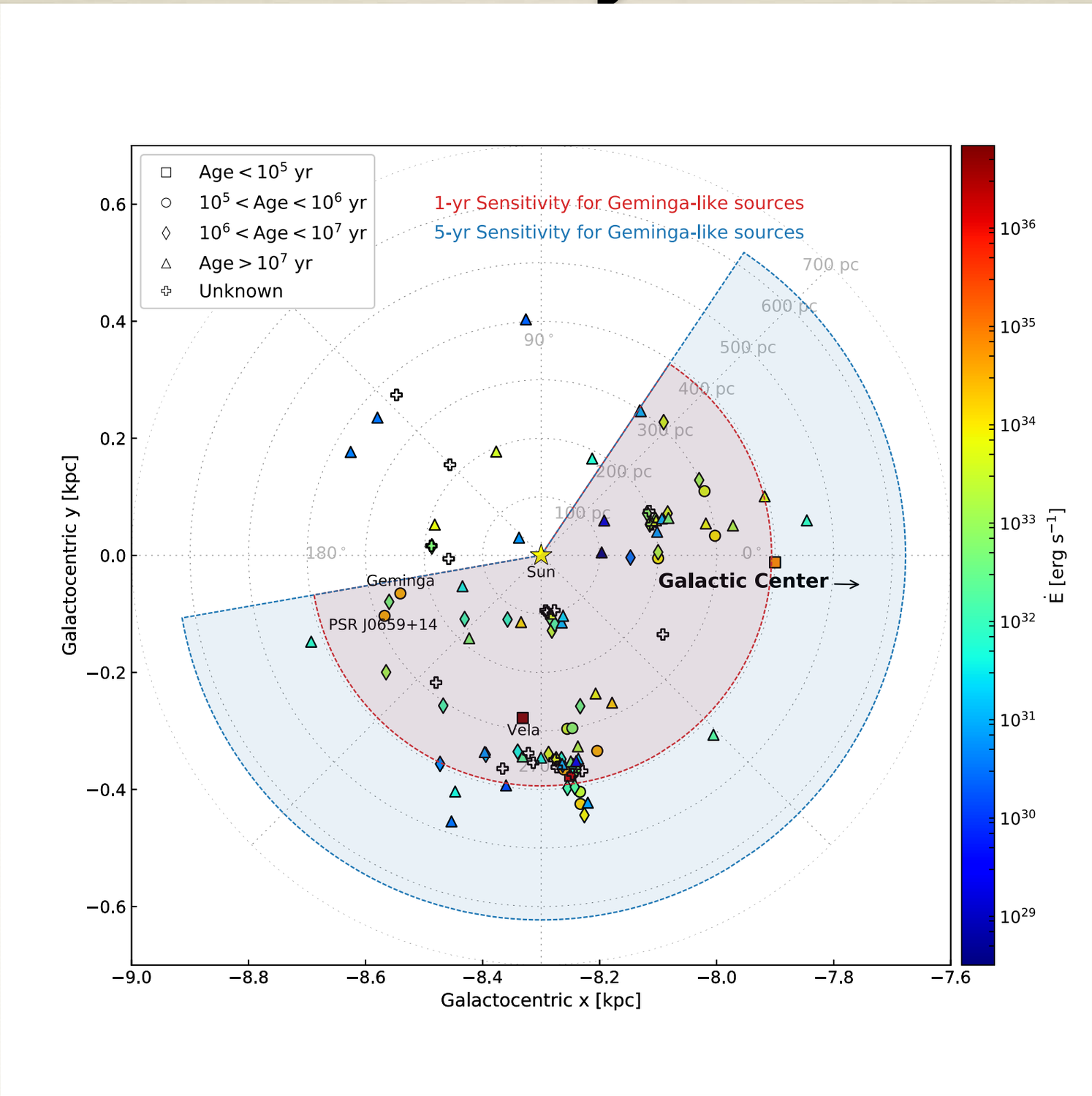




Sensitivity HAWC

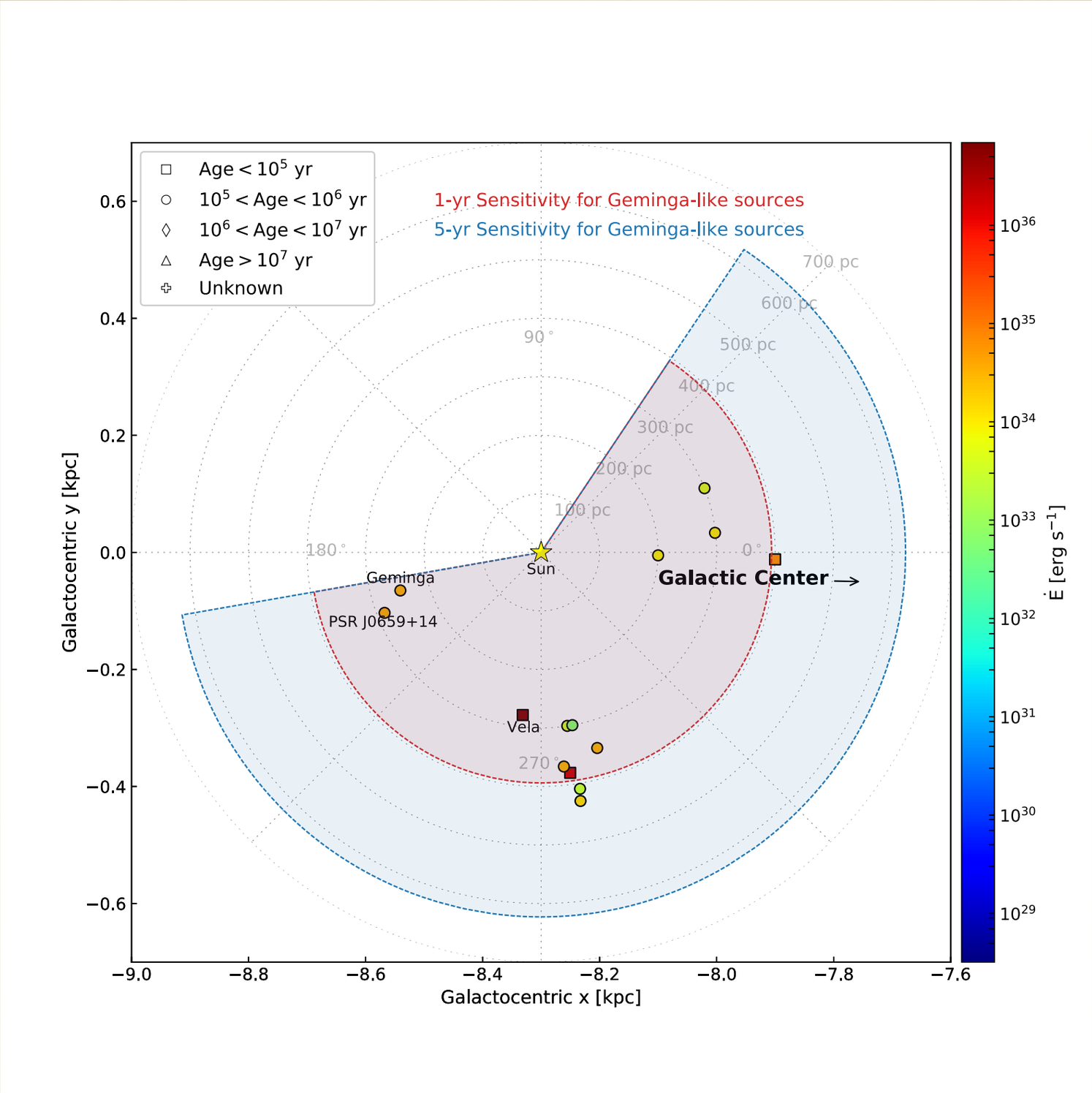


Sensitivity SGSO

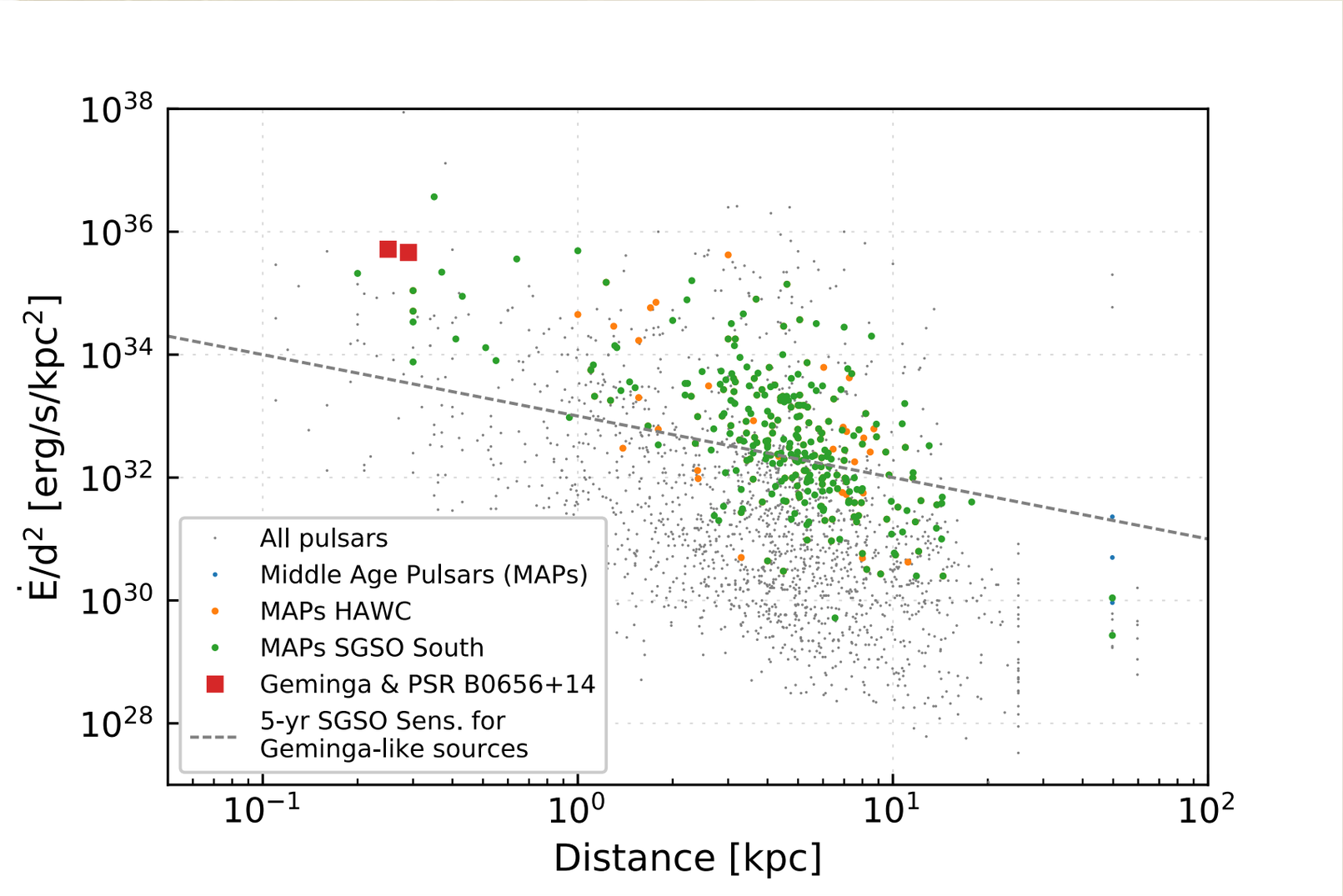


Located at the San Antonio de los Cobres latitude

Sensitivity SGSO (<10^6 yr pulsars)



Geminga-like candidates

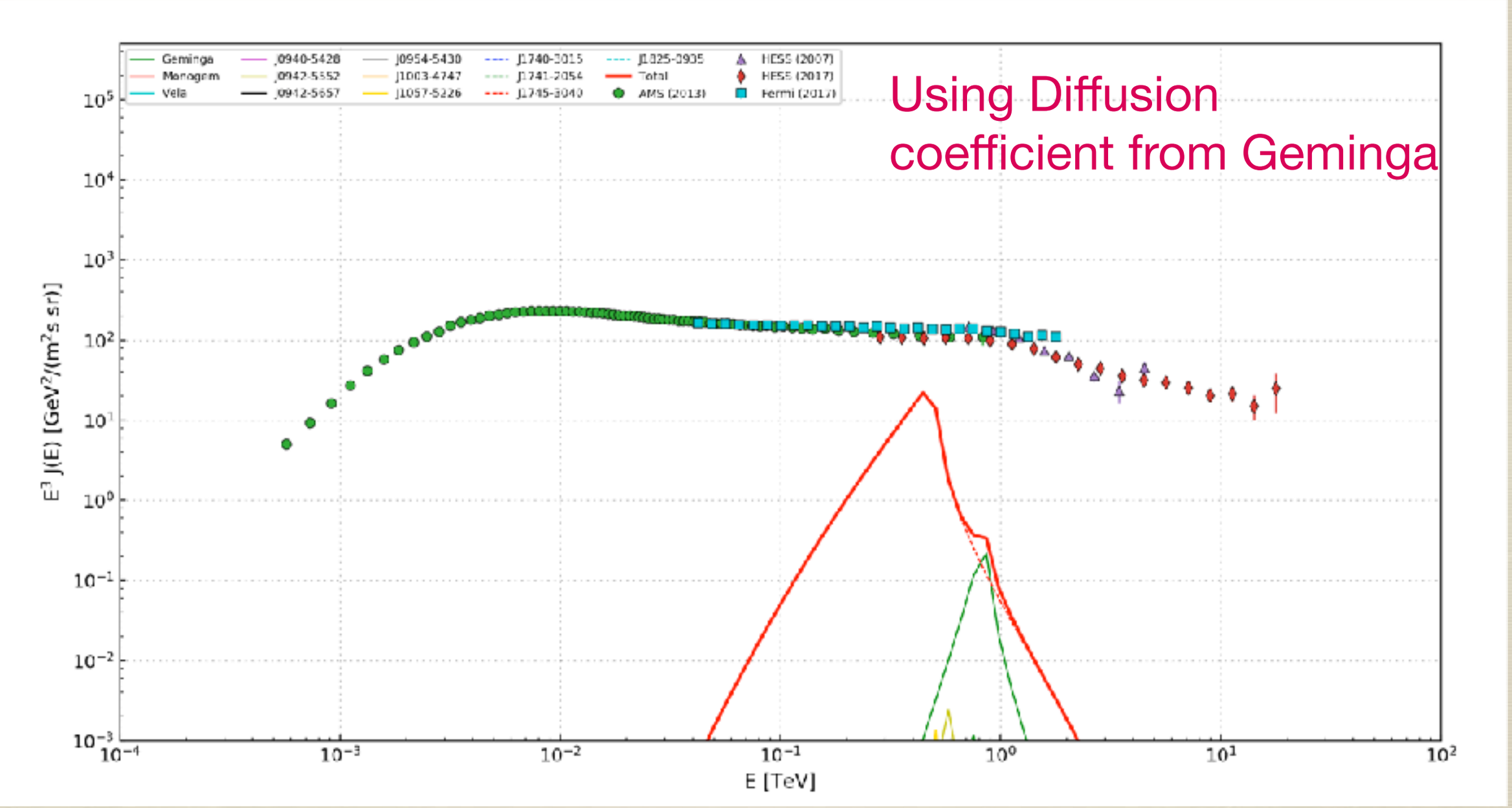


Pulsars located at a similar distance as Geminga and PSR B0656.

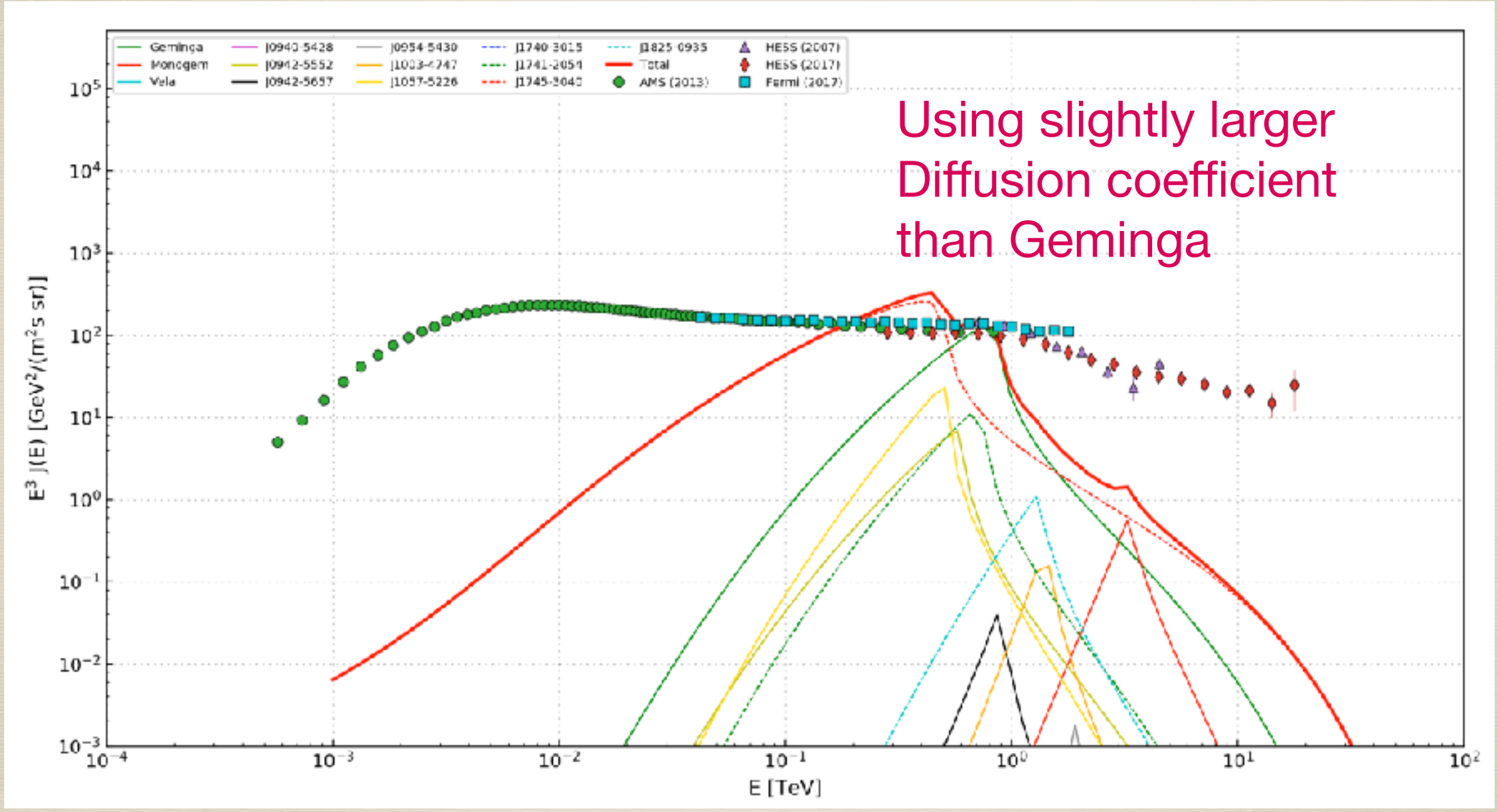
Search for:

- Extended emission
- or Upper Limits on the electrons accelerated

Local All-electron flux



Local All-electron flux



Summary

- Prospects for the detection of halos of middle age pulsars with SGSO very promising.
  - All nearby pulsars with an age < 10^6 yr would be in the reach of such observatory
- We will be able to measure the contribution of all known nearby pulsars to the local all-electron spectrum
- We can also put constrains in the emission of unknown nearby pulsars (or discover them by the gamma-ray emission of their halos).


Thanks
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