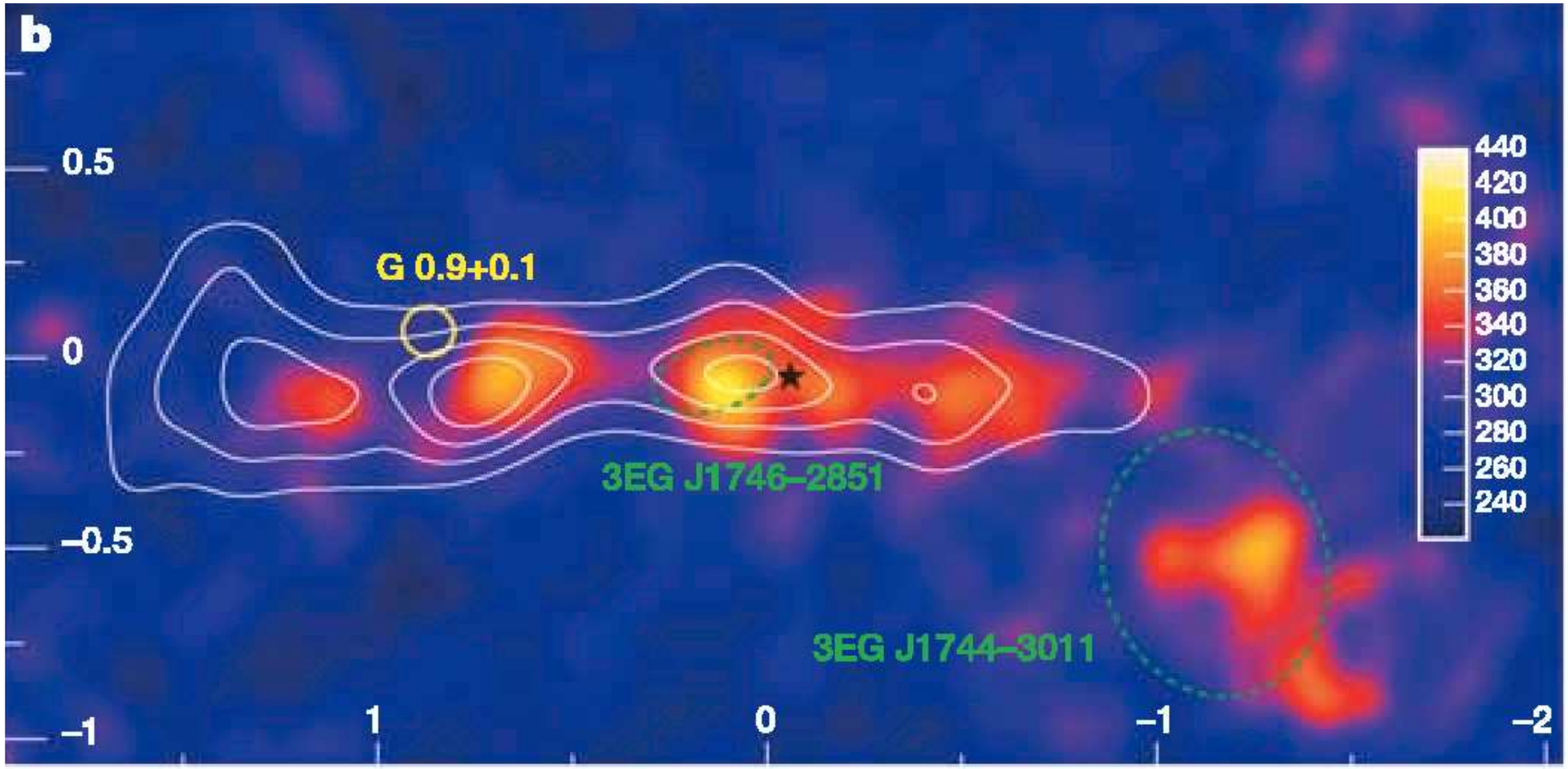
The future of ground-based gamma-ray astronomy

Diffuse galactic gamma-rays
and
shell-type supernova remnants

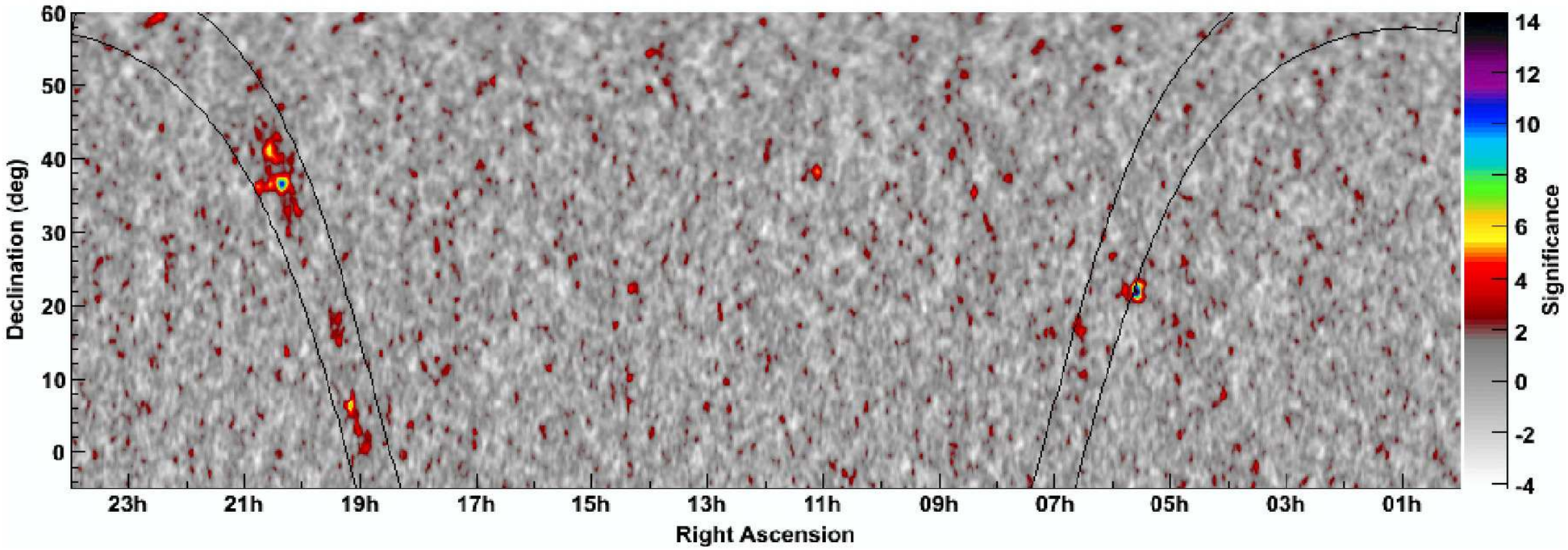
Martin Pohl

On behalf of the SNR/CR working group (about 15 members)

Detections of diffuse emission: 0.18 Crab/sqdeg near GC



HESS gamma-ray count map after subtraction of two bright point sources. The white contour lines indicate the column density of molecular gas traced by CS line emission.



Milagro: **70 Crab/sr at 12 TeV (21 mCrab/sqdeg)**

14 new HESS sources in sky survey of inner Galaxy:

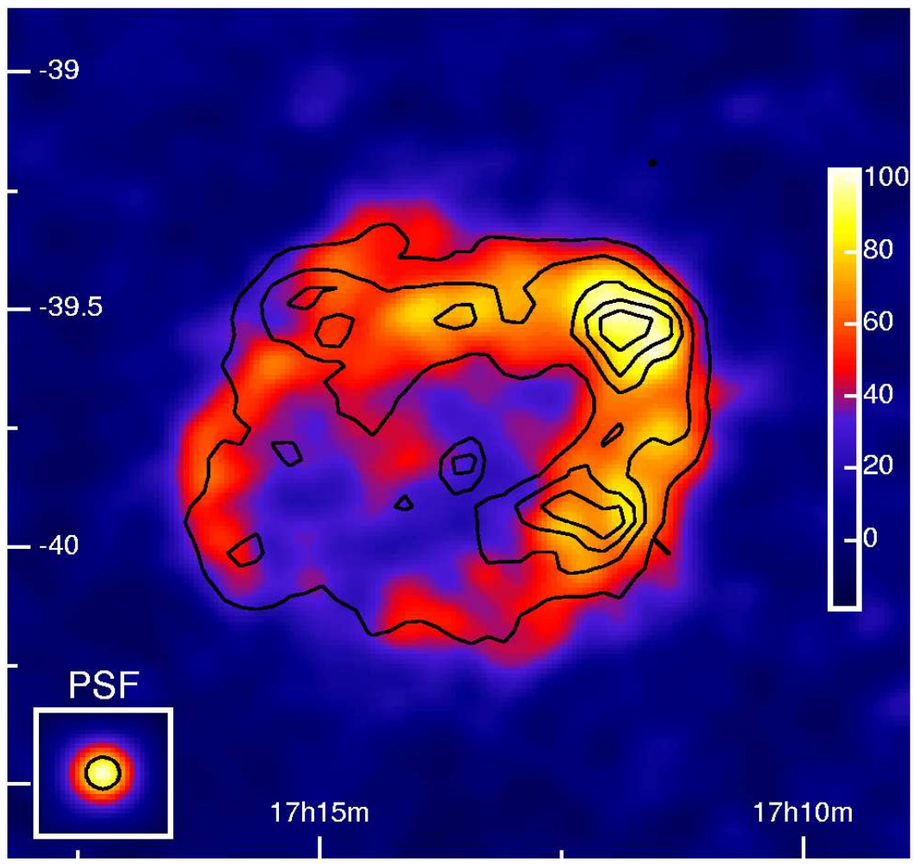
extrapolate: 140 Crab/sr at 12 TeV!

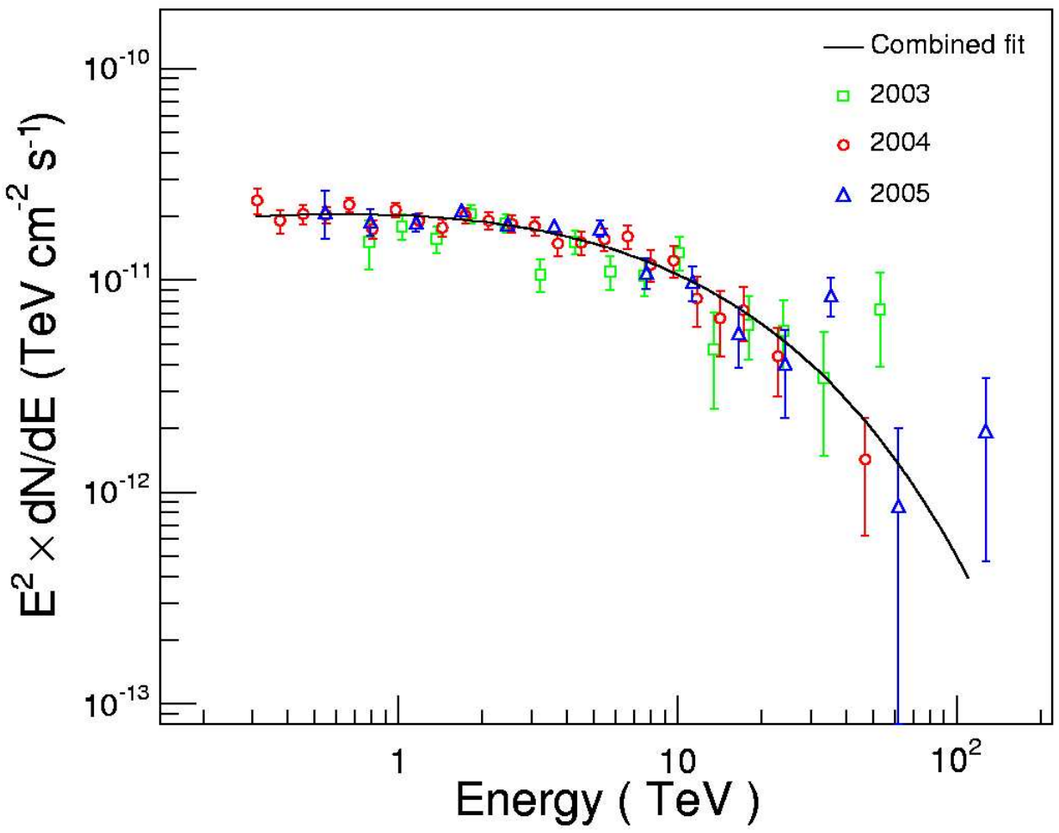
add old sources: GC, RX 1713, etc.

Significant fraction of Milagro intensity is probably sources!

Supernova remnants: RX J1713-3946

Fantastic HESS results





Important questions

Diffuse emission:

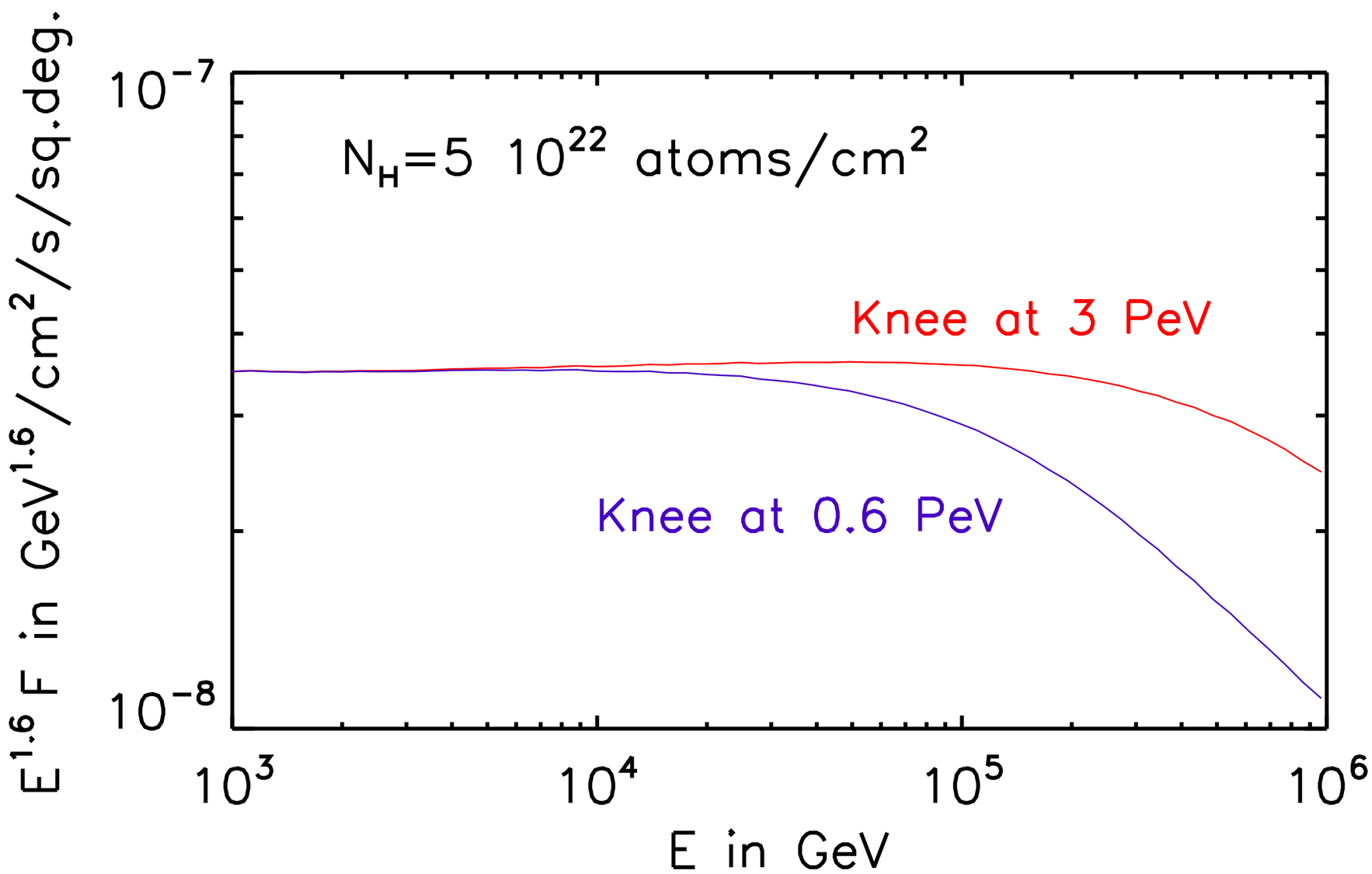
- **What is the origin of cosmic rays above the knee at 3 PeV?**
- **Is the knee a propagation effect?**

  observe a location-dependent knee in diffuse emission
- **What is the distribution of cosmic-ray electrons at energies beyond a few TeV?**

  direct information on the particle acceleration rate

  properties of cosmic rays up to the knee
- **What is the dark-matter contribution to the diffuse emission?**

The signature of the knee in diffuse gamma rays



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Supernova remnants:

- **Do they produce cosmic-ray ions up to the knee?**

  must separate leptonic and hadronic emission

  observe neutrinos?

- **How exactly are the particles accelerated?**

  high angular-resolution spectroscopy

- **What are the bright extended TeV γ-ray sources found with HESS?**

- **With what efficiency are magnetic fields generated at SNR shocks?**

  relates to cosmological magnetic-field generation

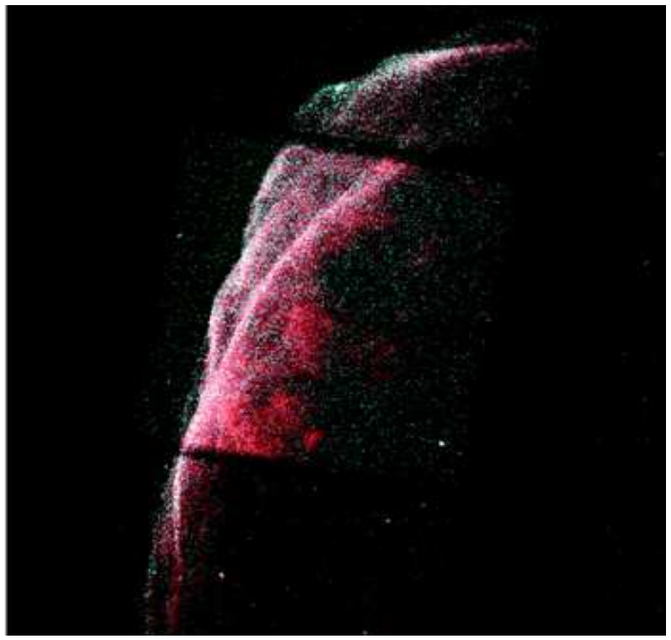
Magnetic-field generation

Nonthermal X-ray filaments (SN 1006)

Strong magnetic field at forward shock!

Runaway instability of energetic particles?

Survival unknown



- **Strong magnetic field maps into particle distribution and emissivities**
  $\longrightarrow$ high angular-resolution TeV observations needed
- **Cosmic structures involve shocks and energetic particles**
- **Cosmological magnetic fields understood through TeV observations?**

AGIS: performance requirements

Field-of-view:

Uncritical as long as larger than structures of interest

Energy threshold:

no gap to GLAST range ($\lesssim 100$ GeV)

Upper energy limit:

up to pair-production limit ($\gtrsim 300$ TeV)?

Angular resolution:

model and subtract sources

relate to X-ray structure (filaments etc.)

avoid source confusion

Sensitivity:

10 x HESS?