IDS report
SWG meeting
SLAC, September 2, 2005

Martin Pohl

Iowa State University

Topics

- Cosmic-ray acceleration in young supernova remnants

- The Galactic Center

  Not covered here

- Gamma-ray production in inelastic collisions

- The distribution of interstellar gas

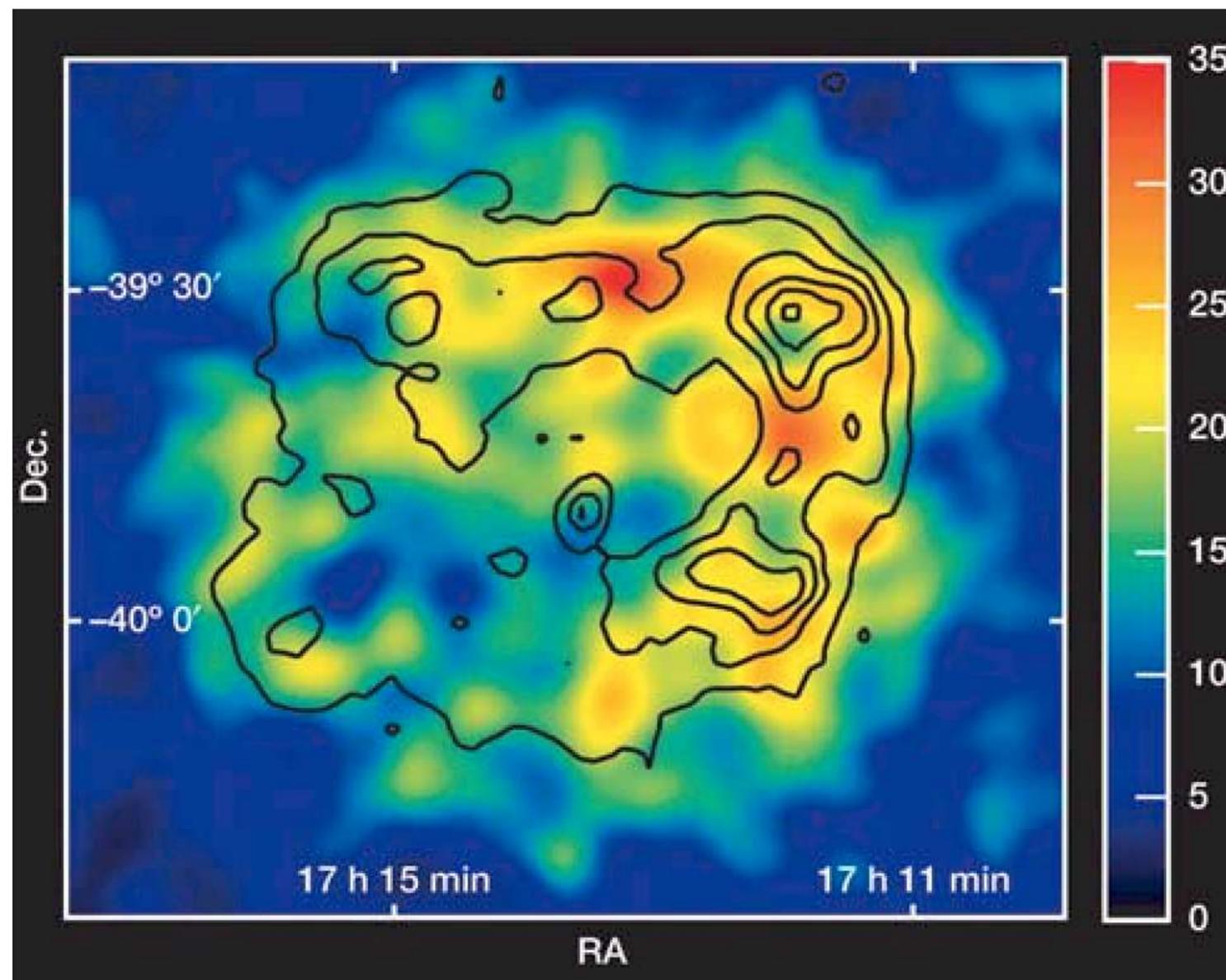- The interstellar radiation field

- Cosmic-ray propagation

Cosmic-ray acceleration in young supernova remnants

Cosmic-ray acceleration

Electrons or protons?

TeV measurements don't tell

HESS map of RX J1713-3946

Non-thermal X-rays

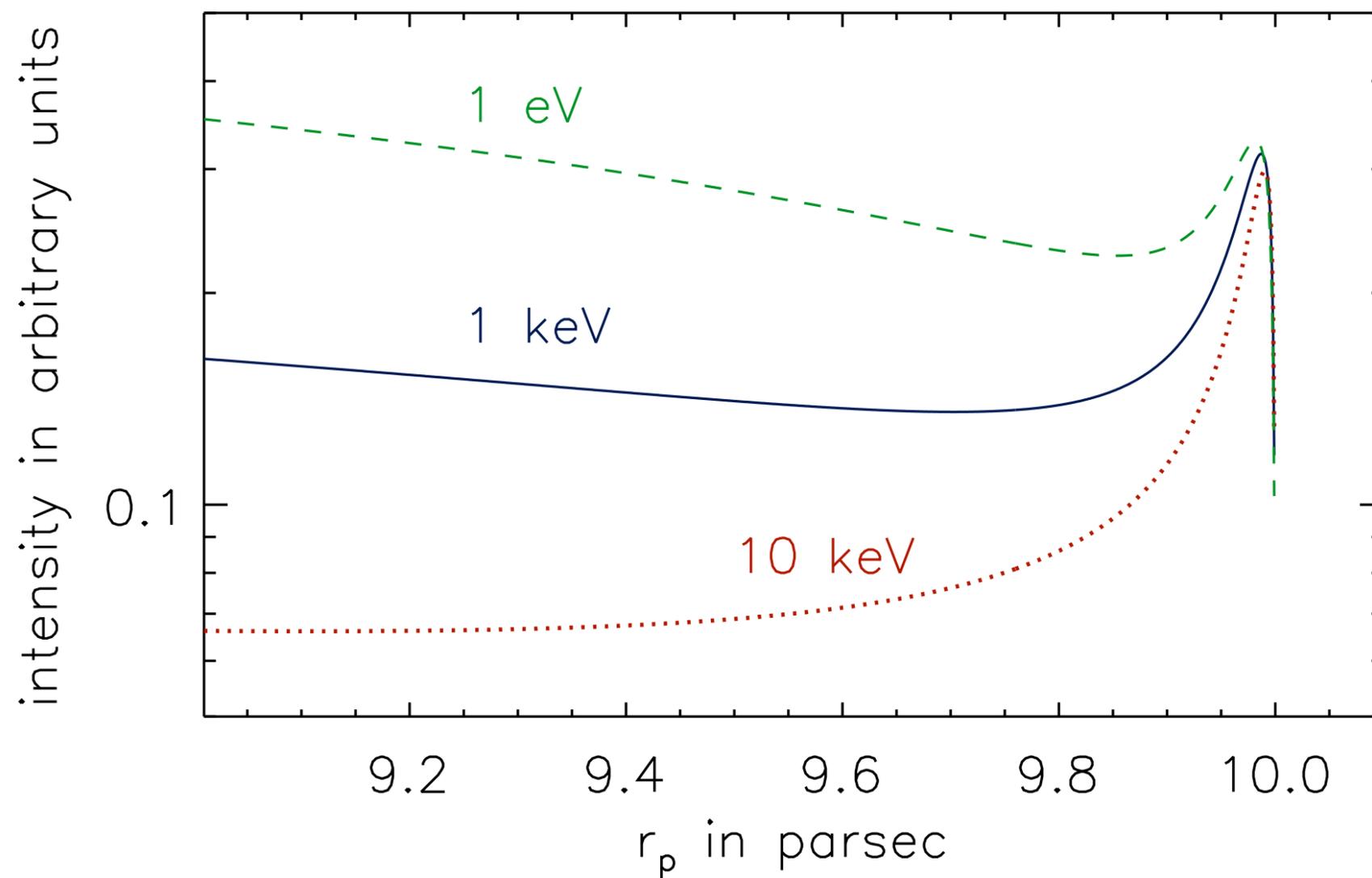come from filaments

Implies strong magnetic field

if limited by energy losses!

• Run-away streaming instability?

• strong compression

   in CR-dominated shock?

Could be a magnetic filament

Damping of turbulent magnetic field produced in the shock

We need GLAST!

Gamma-ray production in inelastic collisions

Use Monte-Carlo Code DPMJET V.3 to simulate particle production (Olaf Reimer)

- p-p, p-A, A-p, and A-A collisions

- production of π, γ, K, ρ, Σ, etc.

Calculate gamma-ray production matrix $\qquad N_\gamma(E_k) = A_{km}\, N_{\mathrm{CR}}(E_m)$

New version of DPMJET may allow to calculate fragmentation and spallation cross sections

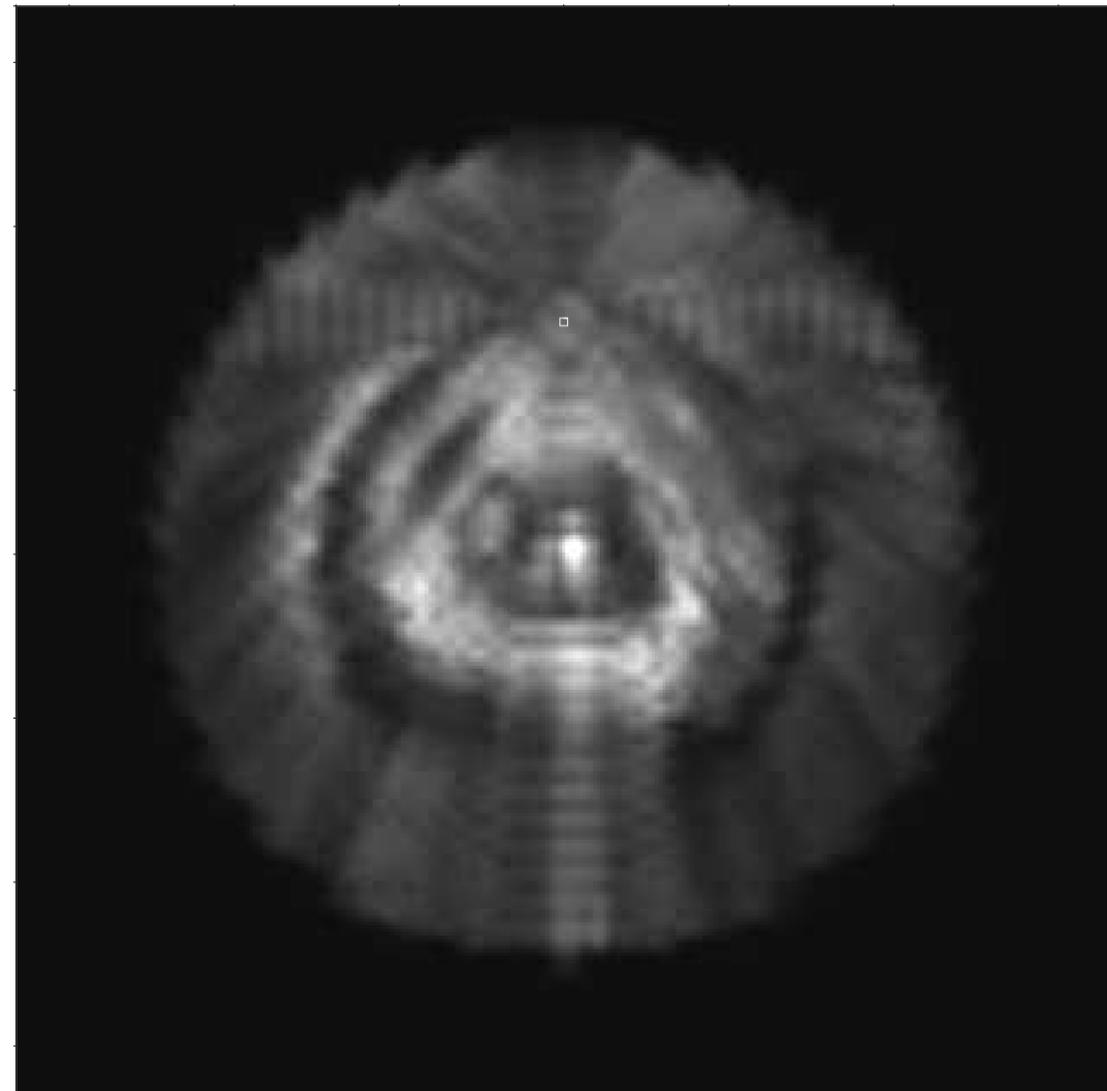# The distribution of interstellar gas

Work planned for this fall.

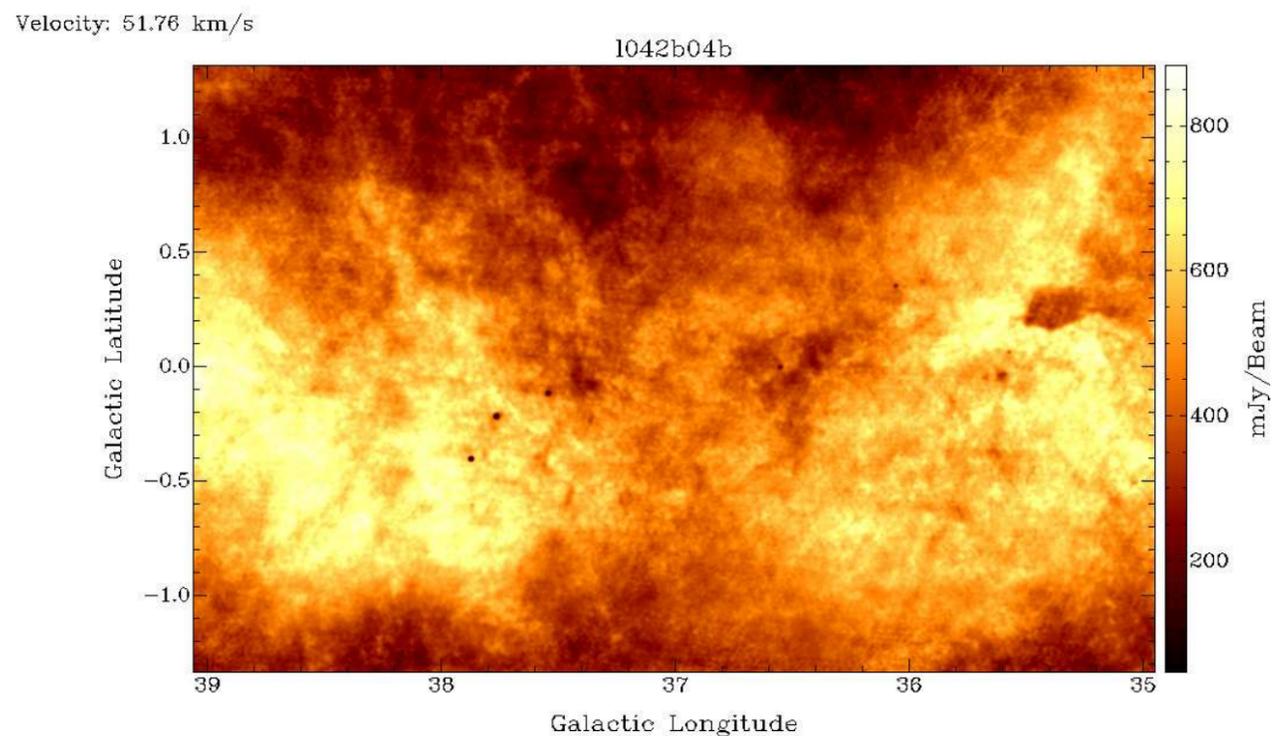Independent modelling by T. Kamae and others

State-of-the-art in EGRET days

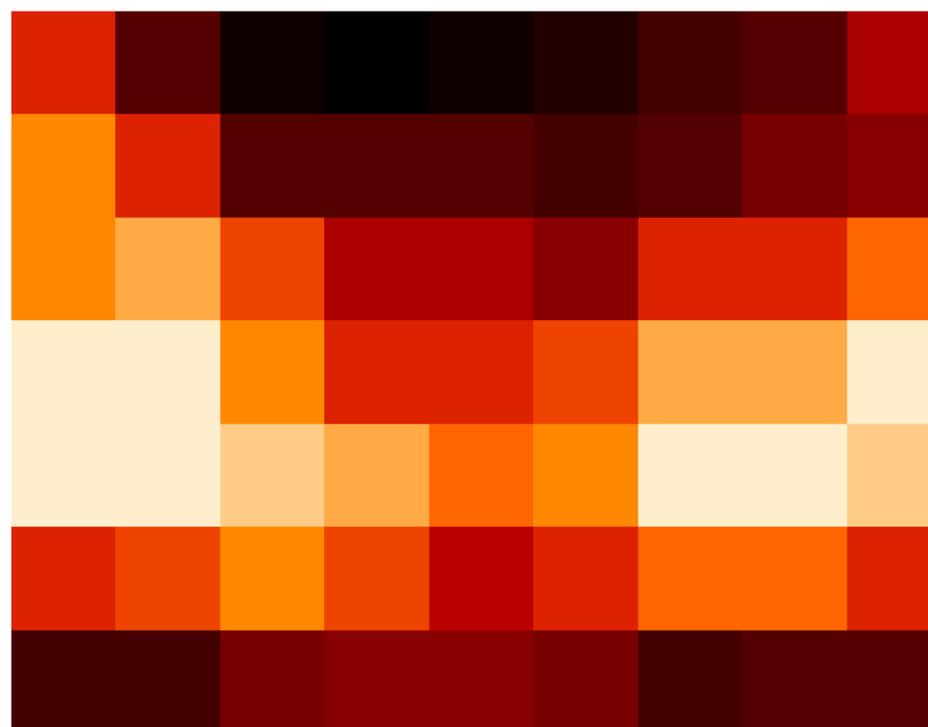Angular resolution $\sim 0.5°$

HI self-absorption hard to detect

Near-far ambiguity difficult to resolve

True situation:

VGPS HI data

arcmin resolution

What we have:

Dwingeloo HI data

$\sim 0.6°$ **resolution**

The interstellar radiation field

Developed to date:

- 2D model (R.-R. Chary & M. Pohl), anisotropy, absorption only

- 2D model (T. Porter & A. Strong), anisotropy, absorption and scattering

$$\Rightarrow \quad \text{much more realistic!}$$

But we want 3D!

Plan: use newly derived 3D gas models and develop Troy's code to 3D!

Cosmic-ray propagation

GALPROP is great

for large-scale distribution and time-independent propagation!

Use Monte-Carlo simulation to follow CR propagation near sources (C.-Y. Huang)

- get fluctuations right!

- get CR distribution around source regions right (superbubbles, etc.)

Late-time solutions may be

- merged into GALPROP

- followed with Monte-Carlo for long time (too expensive?)