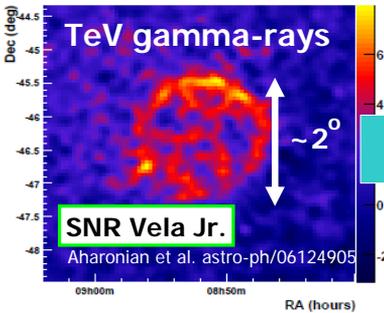# GLAST simulation study of TeV-emitting extended supernova remnants for the origin of cosmic-ray nuclei

Hideaki Katagiri, Hiroaki Yoshida, Tsunefumi Mizuno, Hiromitsu Takahashi, Yasushi Fukazawa, Takashi Ohsugi (Hiroshima Univ.)
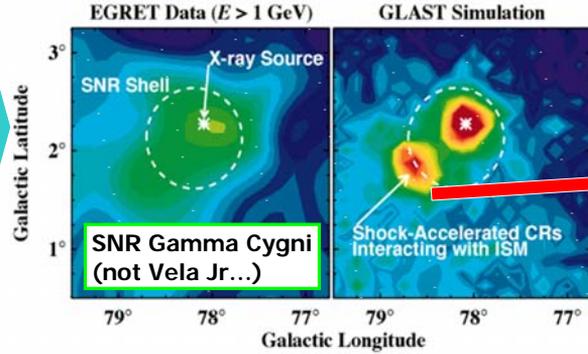
Aim: estimate the feasibility to detect a spectral feature of accelerated cosmic-ray (CR) nuclei, or pi0 bump .
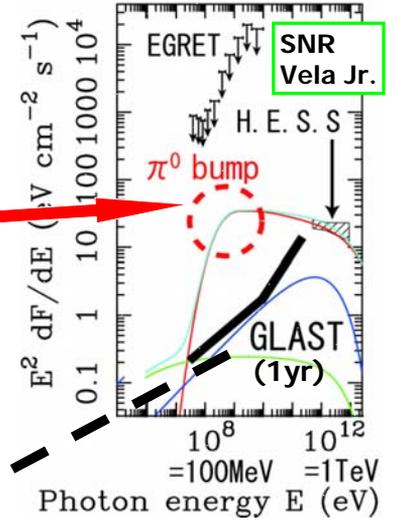
If observed with GLAST,

TeV gamma-rays ~2°
SNR Vela Jr.
Aharonian et al. astro-ph/06124905

EGRET Data ($E > 1$ GeV) GLAST Simulation
X-ray Source
SNR Shell
SNR Gamma Cygni (not Vela Jr...)
Shock-Accelerated CRs Interacting with ISM

EGRET
SNR Vela Jr.
H. E. S. S
π^0 bump
GLAST (1yr)
10^8 =100MeV 10^{12} =1TeV
Photon energy E (eV)

Cosmic rays! (>TeV)

But what particle is accelerated (electron or proton) ?

We can distinguish shell emission from compact sources.

Problem: GLAST sensitivity is not well-estimated
1. Response is not considered event by event.
2. Assumed background emission is extragalactic diffuse.
3. Spectral index is fixed (-2.0).
4. Old response (DC1)

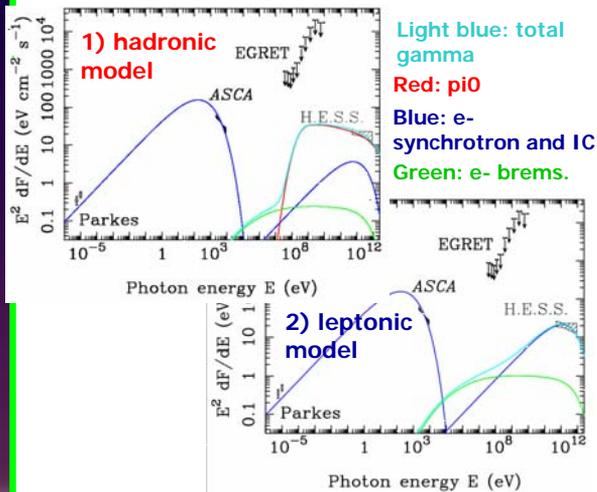**GLAST really can detect pi0 bump? Let's check by simulation!**

Methods

We investigated the TeV-emitting extended SNR, Vela Jr., because
(a) TeV emission => evidence of cosmic rays
(b) Extended
PSF in low energy is poor even with GLAST

(1) To make 1) hadronic model and 2) leptonic model by X-ray and TeV datum.

1) hadronic model

Light blue: total gamma
Red: pi0
Blue: e-synchrotron and IC
Green: e- brems.

EGRET ASCA H.E.S.S. Parkes
10^{-5} 1 10^3 10^8 10^{12}
Photon energy E (eV)

2) leptonic model
EGRET ASCA H.E.S.S. Parkes
10^{-5} 1 10^3 10^8 10^{12}
Photon energy E (eV)

(2) To generate 1yr simulation of each model by Science tools
Assumptions:
• Point source (for simplicity)
• Background emission is GALPROP model + extragalactic diffuse.

(3) To use likelihood for data modeling by Science tools
Models:
• Diffuse = GALPLOP + extragalactic diffuse
• Point source
  a. **Hadronic component** = point source with pi0 spectrum
  b. **Leptonic component** = point source with inverse Compton spectrum, which is power-law (spectral index is fixed at -1.55)
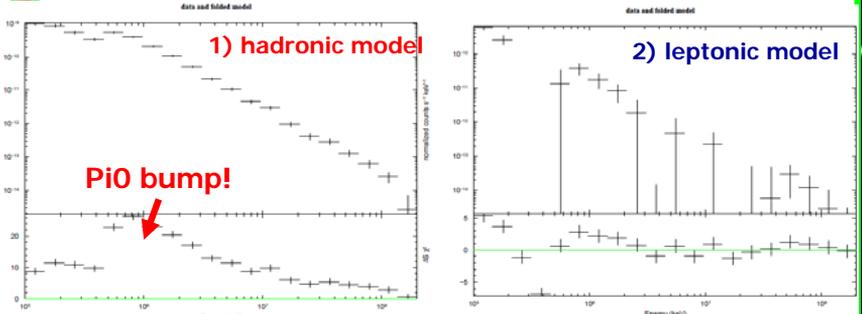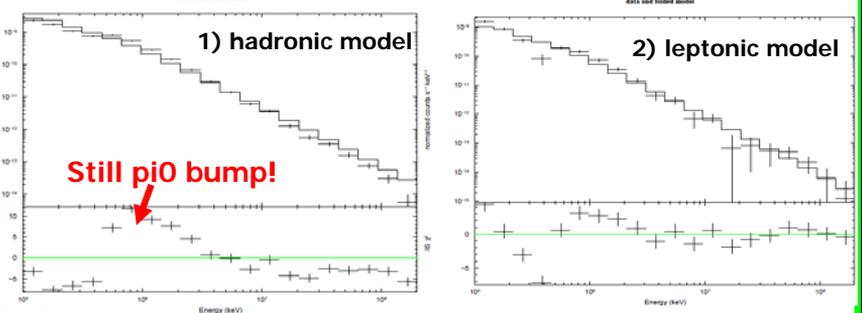
(4) To plot spectrum by XSPEC.

Results

We extracted **hadronic component** from both simulations by likelihood.

data and folded model
1) hadronic model
Pi0 bump!

data and folded model
2) leptonic model

We tried another method for confirmation. By XSPEC, we fitted **total** point-source data (i.e. **hadronic** & **leptonic** component) to a power-law with free spectral index as a arbitrary **leptonic component**.

data and folded model
1) hadronic model
Still pi0 bump!

data and folded model
2) leptonic model

Further studies
• Diffuse simulation and analysis
• More realistic emission models
• Other TeV emitting SNRs (RX J1713-3946 etc.)