

# Study of the TeV gamma-ray emission mechanism of PSR 1706-44 based on the multi-wavelength spectrum

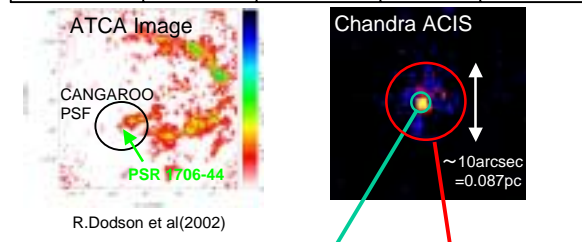
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## Abstract

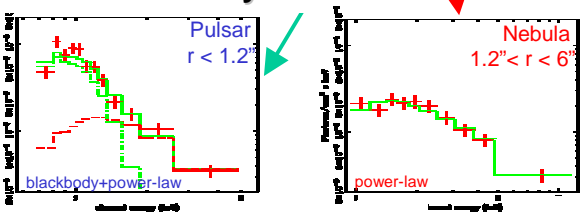
We have observed PSR 1706-44 using the CANGAROO-II 10m telescope in 2000 and 2001. The differential spectrum of gamma rays between 0.5 to 5 TeV is obtained and consistent with previous results. In addition, we analyzed Chandra archive data, to derive the X-ray spectra of the pulsar and the nebula, separately. Compared with the X-ray spectrum, the TeV gamma-ray spectrum seems difficult to be explained by conventional synchrotron nebula model based on Crab nebula.

## 1. Basic data

Name	log L(ergs <sup>-1</sup> )	Distance(kpc)	Period(ms)	log Age(yr)
PSR1706-44	36.53	1.8	102	4.24
Crab	38.65	2.0	33	3.10



## 2. Chandra Analysis



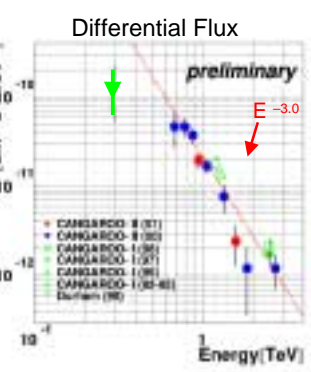
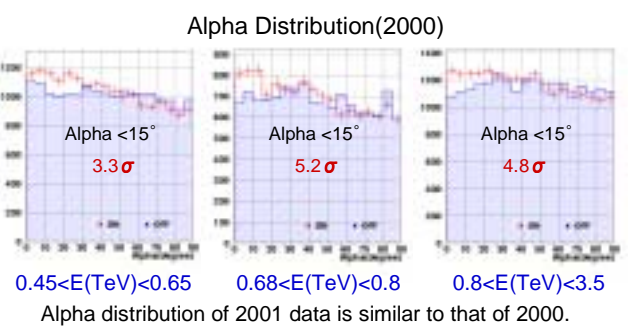
	Pulsar	Nebula
ACIS-S		
-2000 Aug 13(14262sec)		
-Background region		
6'' < r < 60''		
$N_H \sim 5.9^{+0.35}_{-0.25} \times 10^{21} \text{ cm}^{-2}$		
Index $\Gamma$	$2.0^{+0.39}_{-0.72}$	$1.4^{+0.34}_{-0.30}$
kT(keV)	$0.14^{+0.02}_{-0.01}$	---
$\chi^2/\text{d.o.f}$	14.8/8	4.9/7

- X-ray spectra of the pulsar and the nebula are derived individually.
- Obtained nebula spectrum is very hard.
- These results are consistent with Gotthelf et al (2002)

## 3. CANGAROO-II Analysis

Observation time	Analysis Procedure	
	ON	OFF
2000	33h28m	28h42m
2001	36h36m	30h07m
Total	70h04m	58h49m

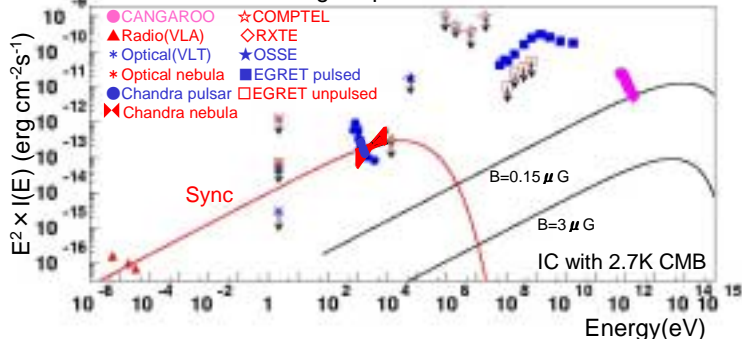
- Selected PMTs exceeding 3.3 p.e. and having more than 4 adjacent hits.
- Imaging cut(Width,Length,Distance)
- Likelihood cut



- Obtained flux is consistent with previous results.
- Above 1TeV, The flux is steep and estimated index is -3.0.
- Energy spectrum seems to vary around 1 TeV.
- This profile can be explained well by the expectation of IC scattering due to electrons.

## 4. Result

Multi-wavelength Spectrum of PSR 1706-44



- X-ray synchrotron peak energy is higher than 10 keV.
- Synchrotron spectrum of the nebula is different from Figure.10 of Aharonian et al(1997).
- Peak intensity of detected TeV gamma-ray flux becomes more ten times stronger than that of X-ray flux from the nebula.
- Expected IC spectrum is estimated much higher than our result.
- TeV gamma-ray flux is difficult to explain by Sync-IC (2.7k CMB) model in the nebula.

## 5. Summary

### Chandra

- X-ray spectra of the pulsar and the nebula are derived separately.
- The nebula spectrum is fitted by power-law with the index of 1.4.

### CANGAROO-II

- The flux obtained by 10m telescope is consistent with previous results.
- Energy flux is steep above 1 TeV and seems to vary around 1 TeV.

### From both results,

- TeV gamma-ray flux is difficult to explain by Sync-IC(2.7k CMB) model in the nebula.

## Reference

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