

TeV Gamma-ray Observations of the PSR B1259-63/SS2883 Binary System with the CANGAROO-II 10-m Telescope

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Abstract

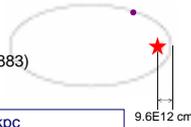
The CANGAROO-II observations of PSR1259-63/SS2883 binary system in 2000 and 2001, 47 and 157 days after the recent periastron, respectively, are reported. It has been pointed out that the pulsar wind and the dense mass outflow of the Be star may emit high energy gamma-rays via IC process or pionic decay. No positive signals are detected at ~0.3 Crab level. Comparing the results with a simple model calculation, the mass-outflow parameters of the Be star are constrained.

1. Introduction

fast rotating **Pulsar** (PSR1259-63) with **Be star** (SS 2883) in a **highly eccentric orbit** Ref.(6-9)(13)

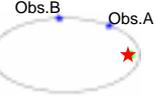
(R.A., Dec.) = (13h02m, -63.50deg.) Distance : 1.5 kpc
 Period : 47.8 ms \dot{E} (erg/s)/d (kpc)² = 9E35/(1.5)²
 Be star : 10th Mag. ~10 M_⊙ ~6R_⊙
 Eccentricity : 0.87 Orbital period : 1236.7 days
 Periastron epoch t : MJD48124.3 ... 1994 Jan., 1997 May, 2000 Oct.

- ASCA: **non-thermal unpulsed X-rays** all over the orbit
 Index: steepening towards t Flux:varies ~10 times Ref.(4)(5)
 - multi-wavelength campaign w/ CGRO in 1994 Jan.:OSSE yes, EGRET U.L. energy spectra: **simple power law** up to 200 keV
 → **synchrotron emission from relativistic electrons.** Ref.(3)(11)
 - CANGAROO 3.8-m: preliminary suggestion of a marginal excess in 1994 May Ref.(12)
- pulsar wind + Be star photon field/disk** may emit TeV Gamma-rays ?
 by IC scattering of the shocked (or UNshocked) pulsar wind ? Ref.(1)(2)
 by pion production and decay ?
 geometrical variation over the orbit.



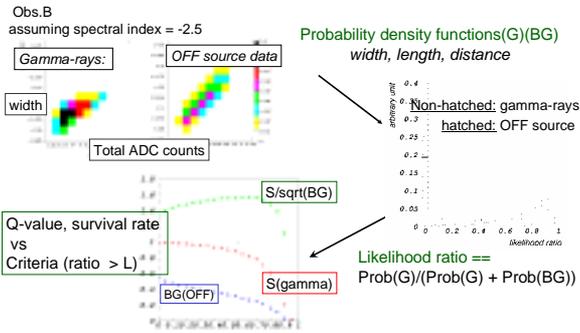
2. CANGAROO-II Observations

- [Obs.A] 2000 Dec.01-04 average MJD 51882
 periastron + 48 days, zenith angle: ~58 deg.
 Recorded Time: ON 201 min. OFF 192 min.
 Effective Obs. Time: ON 196 min. OFF 160 min.
- [Obs.B] 2001. Mar.19-26 average MJD 51991
 periastron + 157 days, zenith angle: ~34 deg.
 Recorded Time: ON 1262 min. OFF 1122 min.
 Effective Obs. Time: ON 623 min. OFF 645 min.

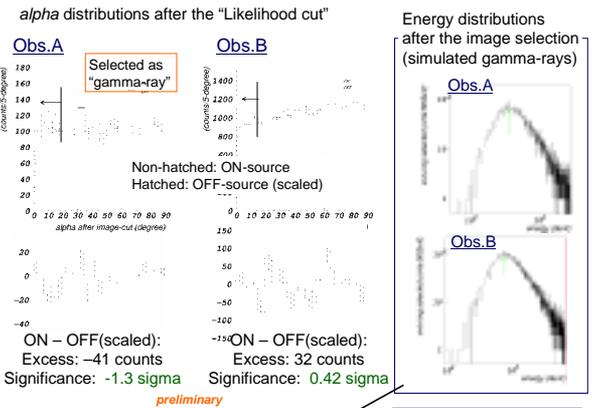


3. Analysis

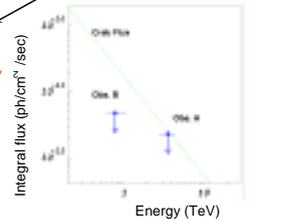
- Background rejection:**
 minimum cluster + timing cut
 < 5 neighboring camera pixels hit (> ~3 p.e. within +/- 35 nsec)
 stability of "event counting rate"
 → cloudy, unstable conditions, effects of stars
- Image analysis of the showers: Gamma-ray selection**
 event samples:
 Gamma-rays ← Monte Carlo simulation inc. experimental conditions
 Background(proton) ← off-source data
 Considering the dependence of the Hillas parameters on shower energy



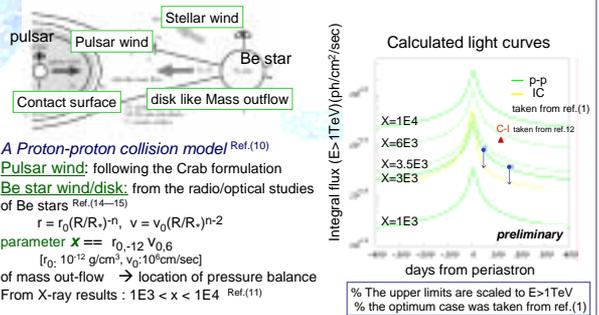
4. Results



No significant gamma-ray signals.
 2-s upper limits are preliminary
 Obs.A F(E>3.7TeV) < 2.3E-12 ph/cm²/sec²
 Obs.B F(E>0.78TeV) < 4.8E-12ph/cm²/sec²



5. model Calculation



6. Summary

The PSR1259-63/SS2883 binary was observed using the CANGAROO-II 10-m telescope in the TeV energy range, at the post-periastron phases.No positive gamma-ray signals were detected. Comparing the upper limits with a model calculation, the mass out-flow parameters of the Be star are constrained. Contributions of IC and Bremsstrahlung emission processes will also be estimated together for comparison, and the results prepared for publication.

Reference

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