

CAL-3065

National Aeronautics and Space Administration

FINAL TECHNICAL REPORT FOR NAG 5-2729

7N-93
001 606

Submitted to: Dr. Jay Norris
NASA/Goddard Space Flight Center
Greenbelt, MD 20771

Submitted by: The Trustees of Columbia University
in the City of New York
351 Eng. Terrace
New York, New York 10027

Prepared by: Columbia Astrophysics Laboratory
Departments of Astronomy and Physics
Columbia University
550 West 120th Street, MC-5247
New York, New York 10027

Principal Investigator: Marco Tavani

Title(s) of Research: Search for Hard X-Ray Emission from Aquila X-1;
High Energy Emission from Gamma-Ray Radio Star
2CG 135+1/LSI 61 305

Report Period: 1 October 1995 – 30 September 1997

Final Technical Report for NAG5-2729
Search for Hard X-Ray Emission from Aquila X-1;
High Energy Emission from Gamma-Ray Radio Star 2CG 135+1/LSI 61 305
Marco Tavani

Several investigations supported by these CGRO grant were completed or are close to completion.

The study of EGRET data for the unidentified source 2CG 135+01 was very fruitful. We discovered transient gamma-ray emission by combining several data obtained since 1994 through 1997 [1]. It is the first time that time variable emission is established for this enigmatic source, and clearly an interpretation in terms of an isolated radio pulsar (Geminga-like) is disfavored now. Our preferred model is a Galactic source, probably an energetic pulsar (such as PSR129-63) in a binary system producing gamma-rays because of pulsar wind/mass outflow interaction. We also accumulated many data concerning the radio source LSI 61 303, the possible counterpart of 2CG 135+01. We show that a possible anti-correlation between radio and gamma-ray emission exists [2]. This anticorrelation is evident only in the energy range above 100 MeV, as demonstrated by the lack of it obtained from OSSE data [3]. If confirmed, this anti-correlation would prove to be very important for the interpretation of the hundreds of unidentified gamma-ray sources currently discovered by EGRET near the Galactic plane, and would point to a new class of sources in addition to AGNs and isolated pulsars.

We also completed the analysis of several time variable gamma-ray sources near the Galactic plane, with the discussion of evidence for transient emission from 2EG J1813-12 and 2EG J1828+01 [4].

We completed several investigations regarding gamma-ray bursts (GRBs), including the study of the brightness distribution for different spectral/duration GRB sub-classes [5], an investigation of acceleration processes and their consequences for GRB afterglow emission [6], the application of the synchrotron shock model of GRBs to X-ray energies [7].

References

- [1] M. Tavani, D. Kniffen, J. R. Mattox, J. M. Paredes, R. Foster, 1998, "The variable gamma-ray source 2CG 135+01", *Astrophys. J. Letters*, 497, 89-91.
- [2] M. Tavani, D. Kniffen, J. R. Mattox, J. M. Paredes, R. Foster, 1999, "Gamma-ray and Radio observations of the 2CG 135+01/LSI 61 303 System", to be submitted to *ApJ*.
- [3] M. Strickman, M. Tavani, I.A. Steele, M.J. Coe, J. Fabregat, J. Marti, J. Paredes, T.S. Ray, 1988, "2CG 135+1 from MHz to MeV – A Multiwavelength Study", *Astrophys. J.*, 497, 419-427 (astro-ph/9711286).
- [4] M. Tavani, R. Mukhardjee, J. Mattox, et al, 1999, "Time Variable EGRET Sources near the Galactic Plane", to be submitted to *ApJ*.
- [5] M. Tavani, 1998, "Euclidean vs. non-Euclidean Gamma-Ray Bursts", *Astrophys. J. Letters*, 497, 21-24 (astro-ph 9802192).
- [6] M. Tavani, 1997, "X-Ray Afterglows from Gamma-Ray Bursts", *Astrophys. J. Letters*, 483, L87-91 (astro-ph/9703150).
- [7] M. Tavani, 1997, "X-Ray Emission of Gamma-Ray Bursts", *Astrophys. J.*, 480, 351-357.