Reports

Two Gamma-Ray Sources and Ancient Guest Stars

ZHEN-RU WANG

On the basis of the fact that the youngest neutron stars such as the Crab pulsar and the Vela pulsar emit strong gamma-ray radiation, it is suggested that a few gamma-ray sources may be identified with young compact sources formed in the events of guest stars. Two such sources, 2CG 353+16 and 2CG 054+01, are identified with guest stars observed in the 14th century B.C. and A.D. 1230, respectively.

THERE ARE 25 DISCRETE GAMMA-RAY sources detected by the European satellite COS B (*1*). Only four are identified with known objects. Two, 2CG 184-05 and 2CG 263-02, are identified with the Crab and Vela pulsars, respectively, through their timing signature and are the most trustworthy identifications. The other two possible identifications are only based on the positional coincidences (with gamma-ray source uncertainties of typically about 1°).

Among 25 discrete gamma-ray sources, the strongest one is the Vela pulsar, PSR 0833-45. The Crab pulsar, PSR 0531+21, is also relatively bright. The Crab and Vela pulsars are the youngest known pulsars. Their strong gamma-ray emissions imply that very young neutron stars may have strong and stable gamma-ray emission. Taking notice of the fact that their successful identifications are due to their remarkable pulsating period in gamma-ray frequencies as well as in other frequencies, I speculate that some of the unidentified gamma-ray sources are young neutron stars, and only the lack of a pulsating feature has prevented a positive identification.

In 1934, Baade and Zwicky (*2*) suggested that neutron stars would be formed in supernova explosions. This opinion has been generally accepted, especially since the discovery of the Crab pulsar in the Crab Nebula. Now, there are altogether more than ten pulsars lying in supernova remnants (*3, 4*). Besides this, more and more Crab-like and composite supernova remnants with compact stars as their central energy sources have been recognized (*5*). This also strengthened the idea that neutron stars were formed in supernova explosions, although some of them lack the pulsating feature to appear as pulsars owing to physical or geometrical reasons.

It is a pity that no supernova explosion has been observed in our galaxy for several hundreds of years. So it seems that there are no extremely young neutron stars in our galaxy. But it is fortunate that there are many historical records about supernova explosions described as guest stars by the ancient Chinese and the people in the Far East (*6, 7*). It is possible that young neutron stars would be formed in some events of guest stars (*8*) and might appear as gamma-ray sources such as the young Crab pulsar and Vela pulsar, but without pulsations being observed. The gamma-ray sources 2CG 184-04 (Crab pulsar) and 2CG 195+04 (Geminga) have been identified with the guest stars of A.D. 1054 and A.D. 437, respectively (*8, 9*). I suggest the identification of two other gamma-ray sources on the basis of their positional coincidences with the corresponding guest stars.

The gamma-ray source 2CG 353+16 was identified by Mayer-Hasselwander *et al.* (*10*) as the dark molecular cloud complex near the star ρ Oph; the identification was justified only from the coincidence of visual positions. I propose another possible identification: 2CG 353+16 may be the compact remnant of the great new star that occurred in the 14th century B.C. That great new star, recorded by the ancient Chinese on an oracle bone of tortoise in the Shang Dynasty (Fig. 1), may be the earliest record of a possible supernova explosion by mankind. Translations of the illustrated text were made by Xi in 1955 (*6*), Needham in 1959 (*11*), and Xi and Bo (*7*) (Fig. 2).

> On the 7th day of the month, a Ji-Si day, a great new star appears in company with Antares (α Sco)—From the second part of the ninth chapter of the book *Yin-Xu-Shu-Qi-Hou-Bian*

The "great new star" should have been remarkably bright to be noticed by the Chinese in the Shang Dynasty. If bright, it was nearby, and the chance of seeing gamma rays from a compact remnant is increased. 2CG 353+16 is just in the visual position: right ascension, 16 hours 27 minutes; declination, −25° 44′, with an uncertainty of ±1°, about 1° from α Sco, in agreement with the position as the inscription of the great new star on the bone of tortoise. 2CG 353+16 is still a gamma-ray source, but fainter than the Crab pulsar. This may be explained if its age is more than twice that of the Crab.

Another gamma-ray source, 2CG 054+01, is unidentified, located at right ascen-

Department of Astronomy, Nanjing University, Nanjing, People's Republic of China.

Fig. 1. An oracle bone with oracle text about a great new star (supernova explosion) that was seen in the 14th century B.C. and recorded by Chinese in the Shang Dynasty.

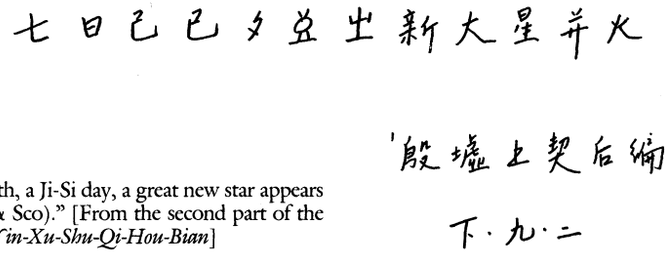

Fig. 2. Chinese record of the appearance of the great new star observed in the Shang Dynasty. "On the 7th day of the month, a Ji-Si day, a great new star appears in company with Antares (α Sco)." [From the second part of the ninth chapter of the book *Yin-Xu-Shu-Qi-Hou-Bian*]

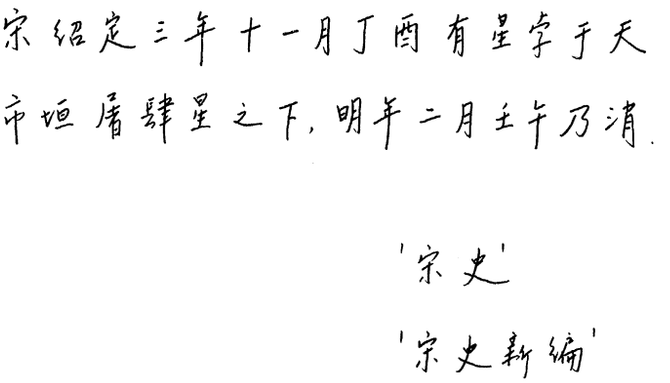

Fig. 3. Chinese record of appearance of the new star A.D. 1230. "(Sung) Reign Shao-Ding, Year 3, Month 11, Day Ding-you [15 December 1230], a po star appeared to the south of 109 Her at the Tieh-shih, until the Day Ren-wu of the second month of the following year [20 March 1231], it disappeared." [From *Sung-Shi* and *Sung-Shi-Xin-Bian*]

sion 19 hours 23 minutes and declination 19° 33′, ±1°. It is in the region where the new star of A.D. 1230 occurred. The ancient record and translation are shown in Fig. 3.

(Sung) Reign Shao-Ding, Year 3, Month 11, Day Ding-you [15 December 1230], a po star appeared to the south of 109 Her at the Tieh-shih, until the Day Ren-wu of the second month of the following year [20 March 1231], it disappeared.—From *Sung-Shi* and *Sung-Shi-Xin-Bian*

The ancient record described the new star of A.D. 1230 as a "po star," that is, a new star with visual magnitude of 3 to 4, and the duration of its appearance as 100 days. It might be considered as a supernova that occurred at a far distance, suffering strong absorption. The visible duration of longer than 6 months suggested by Clark and Stephenson (*12*) as a necessary condition for supernovae is certainly applicable for nearby supernovae. We expect distant supernovae to be fainter and of shorter observed duration. Of course, the chance for confusion with ordinary novae is greater for distant supernovae.

In view of the observation that the young compact remnants of supernova explosions such as the Crab and Vela pulsars emit gamma-ray radiation, it is reasonable to assume that some other young compact remnants of supernova explosions may also emit gamma-ray radiation. From the coincidence of visual positions between gamma-ray sources and ancient guest stars, identifications for 2CG 353+16 and 2CG 054+01 are suggested. More information about their distances, ages, or time signatures are needed to further strengthen these identifications.

REFERENCES AND NOTES

1. B. N. Swanenburg *et al.*, *Astrophys. J.* **243**, L69 (1981).
2. W. Baade and F. Zwicky, *Phys. Rev.* **45**, 138 (1984).
3. Z. R. Wang, *Ke-Xue* **38**, 170 (1986).
4. F. D. Seward, *Comments Astrophys.* **11**, 15 (1985).
5. K. W. Weiler, *The Crab Nebula and Related Supernova Remnants*, M. Kafatos and R. Henry, Ed. (Cambridge Univ. Press, London, 1985), pp. 265–285.
6. Z. Z. Xi, *Acta Astron. Sin.* **3**, 183 (1955).
7. ———, and S. R. Bo, *ibid.* **13**, 1 (1965).
8. Z. R. Wang, in *The Origin and Evolution of Neutron Stars*, D. Helfand and J. Huang, Eds. (Reidel, Dordrecht, in press).
9. G. F. Bignami, P. A. Caraveo, J. A. Paul, *Nature (London)* **310**, 464 (1984).
10. H. A. Mayer-Hasselwander *et al.*, *Ann. N.Y. Acad. Sci.* **336**, 211 (1980).
11. J. Needham, *Science and Civilization in China* (Cambridge Univ. Press, Cambridge, 1959), vol. 3.
12. D. H. Clark and F. R. Stephenson, *The Historical Supernovae* (Pergamon, Oxford, 1977).

13. I wish to thank F. D. Seward, M. V. Zombeck, P. Gorenstein, J. Grindlay, H. Tananbaum, and K. Brecher for their helpful comments and discussions.

20 October 1986; accepted 13 January 1987

Post-Transcriptional Control of Class I MHC mRNA Expression in Adenovirus 12–Transformed Cells

RUUD T. M. J. VAESSEN, ADA HOUWELING, ALEX J. VAN DER EB

Expression of the class I transplantation antigens of the major histocompatibility complex (MHC) is suppressed in cells transformed by the oncogenic human adenovirus 12 (Ad12). This suppression of class I antigen expression, which contributes to the tumorigenic phenotype of the transformed cells, has also been observed in some naturally occurring cancers. In the present study, the rate of transcription initiation of class I genes was measured by a nuclear run-on assay in Ad5- and Ad12-transformed cells of three different types. The rate of transcription was the same in all three. The stability of the class I messenger RNA was also examined and found to be the same in all three cell types. The results indicate that in Ad12-transformed cells the suppression is caused by an inhibition of the post-transcriptional processing of class I MHC messenger RNA in the nucleus.

VIRTUALLY ALL CELLS OF HIGHER eukaryotes express class I transplantation antigens of the major histocompatibility complex (MHC) on their surfaces. These proteins play a crucial role in MHC-restricted cytolysis, a process in which cells expressing foreign antigens, for example, as a result of viral infection, are recognized and destroyed by cytotoxic T-lymphocytes. Previous studies in our laboratory showed that cells transformed by the oncogenic human adenovirus 12 (Ad12), as opposed to cells transformed by the non-oncogenic Ad5, express greatly reduced amounts of class I MHC antigens on their plasma membranes (*1, 2*). This phenomenon has also been observed in a number of naturally occurring cancers (*3–5*). Since the tumorigenicity of Ad12-transformed cells is lost if class I expression is restored (*6*), reduced expression of class I MHC antigens apparently contributes to the tumorigenic phenotype of the cells. We showed previously that the reduction of class I proteins on Ad12-transformed cells is accompanied by a decrease in the level of cytoplasmic class I messenger RNA (mRNA) (*1, 2*). This is confirmed in Fig. 1A, which shows the steady-state levels of the mature cytoplasmic 1.6-kb class I mRNA in untransformed, Ad5-transformed and Ad12-transformed BALB/c baby mouse kidney (BMK) cells, as measured by Northern blotting.

To investigate whether the reduction of class I MHC mRNA concentration is caused by a suppression of RNA transcription, we measured the rate of transcription initiation of class I genes by the use of a nuclear run-on assay with nuclei from the same cells that were used for the experiment in Fig. 1A. The rate of transcription initiation of class I genes in vivo, reflected by the amount of labeled RNA hybridizing to a mouse H-2 class I complementary DNA (cDNA), was the same in the three cell types (Fig. 1B). Similar transcription initiation rates were also found for the γ-actin and β-tubulin genes, which were measured as controls. (The cytoplasmic concentrations of the

Department of Medical Biochemistry, Sylvius Laboratories, 2300 RA Leiden, The Netherlands.