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OBSERVATIONAL DATA ON GALACTIC SUPERNOVA REMNANTS: III. THE SUPERNOVA REMNANTS WITHIN l = 270° - 360°

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SUMMARY: We have collected all the available data of Galactic supernova remnants given in the literature. The data of Galactic supernova remnants located in the Galactic longitude interval l=270°–360° in all the spectral bands are represented in this work. We have adopted distance values for the supernova remnants by examining these data. The data of various types of neutron stars connected to these supernova remnants are also displayed. The remarks of some authors and us on the data and some properties of both the supernova remnants and the point sources are also represented.

Key words. Catalogs – ISM: supernova remnants – Stars: neutron

1. INTRODUCTION

This is the third of a series of papers which present all the available data of Galactic supernova remnants (SNRs) from radio to gamma-ray bands, together with the data of point sources connected to these SNRs. In this paper, the data of the SNRs (and the related point sources) located in the Galactic longitude interval 270°–360° are given. In the previous 2 papers, the data of the SNRs (and the related point sources) in the intervals 0°– 90° (Guseinov et al. 2003a) and 90°–270° (Guseinov et al. 2004a) are presented.

A catalogue of Galactic SNRs was presented by Green (2004). Green's catalogue includes 231 SNRs and about 20 SNR candidates. The data of SNRs in the radio band given by Green (2004) can be listed as follows: angular size, flux at 1 GHz, spectral index, morphological type of SNR, and in some cases, distance. Since, angular sizes of SNRs cannot be determined easily (particularly for SNRs with low surface brightness), for many of the SNRs flux values and angular sizes are denoted by question marks in Green (2004). There are 179 S-type, 27 C-type and 9 F-type SNRs including roughly determined (or dubious) types (e.g. S?) given in Green (2004) (for 16 of the SNRs, types are given as unknown). There are some additional SNRs (together with their available data) in this work which are not present in Green (2004). The SNR types given in Green (2004) pertain only the data in the radio band, so that a SNR which is known to be pure S-type in the radio band may be, for example, C-type when the X-ray data are considered together with the radio data. The data in the γ-ray, X-ray, and optical bands given in the literature are not present in Green (2004); only some remarks and references about such data are given. Our aim is to collect all the available data of Galactic SNRs, to adopt distances of these SNRs as precisely as possible, and to make a preliminary analysis of the data on the SNRs. Since there is no catalogue other than the Green's (2004) which shows data of SNRs, in this work all the data of SNRs were put together for the first time. In Whiteoak and Green (1999) radio maps of SNRs are represented.

We have collected the radio and the X-ray data and, in many cases, the infrared observations, to show the existence of molecular clouds and maser sources. In some cases the data in visual and ultraviolet bands are also given to get information about the chemical abundance and filaments of SNRs. These data can be used to examine the explosion energies, the densities of the ambient media in which the SNRs evolve, the initial masses of the progenitors, the changes in the parameters of the SNRs during their evolution, different types of point sources in the SNRs, and the mechanisms which lead to differences in the types of these point sources. The chemical abundance may give us some information about the mass of the progenitor.

As it is known, SNRs are the sources of cosmic rays and it is important to examine SNRs to get information about the accelerations of electrons and protons. Here, it is necessary to have information about the character of X-ray radiation and the origin of γ-ray radiation. Therefore, we also present the data about the 'hard' radiations. We have not only collected the data on SNRs which were determined directly from observations, but we have also included the data obtained using various models and approaches. In particular, we have used the data presented in this work to construct an improved Σ-D relation, where Σ is the surface brightness of the SNR and D is its diameter. We have adopted distances for all the Galactic SNRs by considering the distances found from our Σ-D relation together with all the distance values given in the literature found by various different methods, and the data related to the distance and the density of the environment (Guseinov et al. 2003b). Radio data on SNRs (morphological type, spectral index, angular size and 1 GHz flux) given in parenthesis after the name of the SNR are taken from Green (2004). Σ values, also given in the parenthesis, were calculated using the 1 GHz flux and angular size values given in Green (2004). For all the other data, except the adopted distance values and the distances found from our Σ-D relation (Guseinov et al. 2003b), the references are given. The abbreviations used in the text for commonly used observed quantities of SNRs are as follows (the units are given in parenthesis):

1) **SNR type (radio):** S = Shell; F = Filled Center (Plerion); C = Composite
2) **The angular size of the SNR:** θ (arcmin)
3) **Radio spectral indices of the shell, the plerionic part, and the whole SNR:** α
4) **Distance:** d (kpc)
5) **Column density of neutral hydrogen:** N_{HI} (cm^{-2})
6) **Interstellar optical absorption:** A_V (mag)
7) **Spectral indices for the X-ray radiation of the shell, the plerionic part, and the whole SNR:** SI
8) **Radio flux at 1 GHz:** F (Jy)
9) **Flux in X-ray band:** F_x (erg cm^{-2} s^{-1})
10) **Temperature in the shell or the plerionic part:** kT (keV)
11) **Velocity of the shock front or the expansion velocity:** V (km/s)
12) **Surface brightness:** $\Sigma_{1\ GHz}$ (W m^{-2} Hz^{-1} sr^{-1})
13) **Luminosity in X-ray band:** L_x (erg/s)
14) **For SNR environment density and clouds:**
a) **Molecular cloud:** MC
b) **Maser source (due to interaction of SNR with MC):** MS
c) **Dust cloud:** DS
d) **Number density of particles in front of the SNR, in the shell, in the plerionic part, or in different types of clouds and filaments:** n (cm^{-3})
15) **Kinetic energy of the shell or the plerionic part:** E_k
16) **Age of the SNR:** t (kyr)
17) **Explosion energy of the SNR:** E (erg)
18) **X-ray radiated mass:** M_x ($M_\odot$)
19) **Ejected mass:** M_{Ej} ($M_\odot$)
20) **Swept-up mass:** M_s ($M_\odot$)
21) **Magnetic field:** B (mG)

Abbreviations for data of the point sources connected to SNRs are given as:

1) **Type of the point source:**
a) **Radio pulsar:** PSR
b) **X-ray pulsar:** XRP
c) **X-ray point source:** XPS
d) **Neutron star:** NS
2) **Ratio of the angular distance of the point source from the geometric center of the SNR to the average angular radius of the SNR:** $\beta \equiv 2\Delta\theta/\theta$
3) **Spin period:** P (s)
4) **Derivative of spin period:** $\dot{P}$ (s/s)
5) **Characteristic age of point sources:** τ (kyr)
6) **Dispersion measure:** DM (pc/cm^3)
7) **Radio flux values at 400 MHz and 1400 MHz:** F_{400}, F_{1400}
8) **Radio luminosity at 1400 MHz:** L_{1400} (Jy kpc^2)
9) **Pulsar wind (powered) nebula:** PWN
10) **Spectral index:** SI
11) **Photon index:** Γ
12) **Space velocity:** V (km/s)
13) **Visual apparent magnitude:** m_V (mag)
14) All other physical quantities of point sources are presented in the form similar to SNRs'.

2. OBSERVATIONAL DATA OF SNRs AND POINT SOURCES

G272.2-3.2 (S?, α=0.6, θ=15?, F=0.4, $\Sigma=2.68\times10^{-22}$)

d=12.9 kpc (Σ-D), d=9 kpc adopted.

G279.0+1.1 (S, α=0.6?, θ=95, F=30?, $\Sigma=5.00\times10^{-22}$)

d=1.8 kpc (Σ-D), d=1.8 kpc adopted.

G284.3-1.8 (MSH 10-53, S, α=0.3?, θ=24?, F=11?, $\Sigma=2.87\times10^{-21}$)

d=3 kpc [3,4], d=5.4 kpc (Σ-D), d=5.2 kpc adopted. t~10 kyr [3,4].

Remark: SNR G284.3-1.8 is an incomplete radio shell with nonthermal spectrum and with significant polarization, interacting with molecular clouds [3,4].

Point Source PSR J1016-5857

β=1 [1], β=1.3 [3]; l=284.08°, b=-1.88° [3]; d=6.5 kpc [2]; DM=394.2 pc/cm^3 [2]; Log L_{1400}=1.289 [2]; P=0.1074 s [2]; $\dot{P}=8.06\times10^{-14}$ [2]; Log τ=4.32 [2,3]; $\dot{E}=2.6\times10^{36}$ erg/s [3]; $B=3\times10^{12}$ G [3]; V$\cong$500 km/s at d=3 kpc [5]; F_{1400}=0.46 mJy [3]; $L_x\sim10^{33}$(d/3 kpc)^2 erg/s (0.1-4.5 keV) [3], $L_\gamma\sim1.6\times10^{35}$(d/3 kpc)^2 erg/s (100 MeV-10 GeV) [3]; $N_{HI}\sim10^{22}$ cm^{-2} [3].

Remarks: The PSR is located just outside, and possibly interacting with, the shell SNR G284.3-1.8 [3].

The PSR is ~15′ away from the approximate geometrical center of the SNR [3].

The probability of finding a PSR lying by chance within 15′ of a SNR in this region of the Galaxy (270°<l<300°) is ~5% [3].

The location of the PSR at the tip of a bright structure connected to the SNR is suggestive of a physical association between them [3].

The PSR is located inside the error box of the unidentified EGRET source 3EG J1013-5915 for which it represents a plausible counterpart [3].

Since, d=6.5 kpc [2] and the angular size of the SNR is small, there may be a connection. But if we take into account the large value of β, the connection is not so likely to be true.

[1] Manchester et al. 2002; [2] Guseinov et al. 2004b; [3] Camilo et al. 2001; [4] Ruiz and May 1986; [5] Lorimer, D. R. 2003.

G286.5-1.2 (S?, α=?, θ=26×6, F=1.4?, $\Sigma=1.35\times10^{-21}$)

d=11.8 kpc (Σ-D), d=10 kpc adopted.

G289.7-0.3 (S, α=0.2?, θ=18×14, F=6.2, $\Sigma=3.70\times10^{-21}$)

d=7.9 kpc (Σ-D), d=7.9 kpc adopted.

G290.1-0.8 (MSH 11-61A, S, α=0.4, θ=19×14, F=42, $\Sigma=2.38\times10^{-20}$)

F-type in X-ray [3]; d=6.9 kpc (from the shifted H_α line) [1], d=3.6 kpc (Σ-D), d=5.5 kpc adopted.

$N_{HI}=1.1\times10^{22}$ cm^{-2} [3]; MS [4]; t=10^4 yr [2]; M_s=250 $M_\odot$ [5].

Remark: There are HII regions around the SNR [1]. The surrounding medium is dense [4].

[1] Rosado et al. 1996; [2] Marsden et al. 1999; [3] Rho and Petre 1998; [4] Koralesky et al. 1998b; [5] Morini et al. 1988.

G291.0-0.1 (MSH 11-62, C, α=0.29, θ=15×13, F=16, $\Sigma=1.23\times10^{-20}$)

d=3.5-10 kpc [1], d=5.6 kpc (Σ-D), d=6.5 kpc adopted.

$E_{exp}=2\times10^{50}$ erg if d=10 kpc [1]; $N_{HI}=1.5\times10^{22}$ cm^{-2} [1]; n_0=0.034 cm^{-3} (the average ambient density) [1]; B~70 μG [1]; t=2.5 kyr if d=3.5 kpc and t~10^4 yr if d=10 kpc [1].

Remarks: The X-ray emission comes from 2 parts of the SNR [1].

No point source has been found in the radio band. In X-ray the pulse fraction is <10% [1].

[1] Harrus et al. 1998.

G292.0+1.8 (MSH 11-54, C, α=0.4, θ=12×8, F=15, O-rich, $\Sigma=2.35\times10^{-20}$)

d=3 kpc [1], d~5.4 kpc [5], d~4.8 kpc [7], d$\geq$6 kpc (HI absorption) [8], d=6.1 kpc (Σ-D), d=5 kpc adopted.

α=-0.5±0.1 [8]; $L_X=6\times10^{34}$ erg/s (0.2-4 keV) (=0.005$\dot{E}$ for PWN) [4]; t=2.4-2.85 kyr [7], t=2500 yr [8]; $N_{HI}=(0.5\pm0.1)\times10^{22}$ cm^{-2} [7], $N_{HI}=4.75\times10^{21}$ cm^{-2} [11]; $kT_{shock}=0.95\pm0.15$ keV [7]; $V_{shock}=880\pm70$ km/s [7]; $n=0.51^{+0.15}_{-0.11}$ cm^{-3} [7]; $E=0.18^{+0.08}_{-0.06}\times10^{51}$ erg [7]; $M_s=15.6^{+4.5}_{-3.5}$ $M_\odot$ [7].

Remarks: This Oxygen-rich SNR is plerion in X-ray [2].

This SNR is one of the 3 Oxygen-rich SNRs in the Galaxy (the other 2 being Cas A and Puppis A). The O-rich SNRs in the Magellanic Clouds are M132D, E0540-69.3 and E0102.2-7219 [2].

t$\leq$1600 yr because the matter thrown out during the supernova explosion has not yet mixed with the matter in the ambient medium [3].

Mass of the progenitor is estimated to be 30-40 $M_\odot$ [7].

For d=6 kpc and t=2500 yr, the expansion velocity is ~1200 km/s, the ambient density is ~0.9 cm^{-3}, the ejected mass is ~5.9 $M_\odot$ and the supernova explosion energy is $\sim1.1\times10^{51}$ erg [8].

SNR G292.0+1.8 is a composite SNR, clearly showing a SNR blast-wave, a central PSR and a PWN [8].

Filled center radio morphology [9].

A nebular magnetic field $B_n\sim3$ μG, as inferred from the radius of the termination shock surrounding the PSR, seems more likely [10].

A magnetic field strength of $\leq$8 μG would ensure that the X-ray synchrotron cooling time is $\geq$2000 yr [11].

In order that the pressure in the synchrotron nebula be sufficiently strong to balance the ram pressure of the pulsar's wind requires a value of B~3 μG. The total energy in the nebula would then be $\sim4\times10^{49}$ erg, contained nearly entirely in particles [11].

Point Source PSR J1124-5916 [4],
CXOU J112439.1-591620 [2,11]
(Radio and X-ray Pulsar)

d=5 kpc [4], d=6.8 kpc [6]; P=0.1353 s [4]; $\dot{\mathrm{P}}$=7.471$\times10^{-13}$ [4]; DM=330 cm^{-3}pc [4]; F_{1400}=0.08 mJy [4]; τ=2900 yr [4]; $\dot{\mathrm{E}}$=1.2$\times10^{37}$ erg/s [4]; B=10^{13} G [4]; $\mathrm{L}_{1400}\sim$2 mJy kpc^2 at $\sim$5 kpc [4]. N_{HI}=3.1$\times10^{21}$ cm^{-2} [11]; Γ=1.6 [11]; L_x(unabsorbed)=7.2$\times10^{32}$ erg/s (0.3-10 keV, at 6 kpc) [11]; T(blackbody) < 1.18$\times10^6$ K [11]; m_B>22 [11]; $\mathrm{V}_{transverse}$(PSR)$\sim$770($\mathrm{d}_{4.8}/\mathrm{t}_{1600}$) km/s [2].

Remarks: For the 1.3$''$ region at the center of the plerion SI=1.72. This shows the presence of a fastly rotating pulsar and wind nebula around it [2].

At 20 cm the PWN has a flux density of 5.5 Jy and a spectral index $\alpha\cong$-0.05. At 1 keV its flux density is about 2-4 μJy and the spectral index is -1.1 $\leq\alpha\leq$ -0.7 [2].

An X-ray point source (CXOU J112439.1-591620) is centered on a diffuse synchrotron nebula in G292.0+1.8 [2].

There is PWN [4,7].

The nearly east-west extension and jet-like structure extending to the south could be indicative of a toroidal and collimated outflows reminiscent of Crab-like PWNe [7].

Age of the SNR is comparable to the pulsar's characteristic age and this confirms the pulsar/SNR association [7].

Pulsations have been detected from this source in X-rays also [10].

Pulsed X-ray emission from the compact object CXOU J112439.1-591620 within the SNR G292.0+1.8 from *Chandra* observations [11].

The X-ray period P=0.13530915 s is consistent with extrapolation of the radio pulse period of PSR J1124-5916 for a spindown rate of $\dot{\mathrm{P}}$=7.6$\times10^{-13}$ s/s [11].

The optical luminosity of the pulsar is at least a factor of 5 below that of the Crab pulsar [11].

[1] Braun et al. 1989; [2] Hughes et al. 2001; [3] Murdin and Clark 1979; [4] Camilo et al. 2002a; [5] Goss et al. 1979; [6] Guseinov et al. 2004b; [7] Gonzalez and Safi-Harb 2003a; [8] Gaensler and Wallace 2003; [9] Lockhart et al. 1977; [10] Hughes and Slane 2003; [11] Hughes et al. 2003.

G292.2-0.5 (S, α=0.6?, θ=20$\times$15, F=7?, Σ=3.51$\times10^{-21}$)

d=5 kpc [5], d=7.3 kpc (Σ-D), d=7 kpc adopted.

θ=15$'$ [1]; α=0.6 [1]; D=21.8 pc if d=5 kpc [1]; SI=2.3 [3]; F_{1400}=5.6 Jy [1]; Σ(1 GHz)=4.7$\times10^{-21}$ Wm^{-2}Hz^{-1}sr^{-1} [1]; L_x=(3-4)$\times10^{35}$ erg/s (0.5-10 keV) [3]; E=10^{51} erg [1]; V_s=5900 km/s [6]; t<3 kyr [1].

Remark: No radio emission has been detected from any PWN [6].

Point Source PSR J1119-6127 [1] (Radio PSR and X-ray source [8])

$\beta\leq$1 [1], β=0.00 [5]; d=5 kpc [5], d=2.4-8 kpc [7], d=7.5 kpc [4], d$\sim$6 kpc [8]; P=408 ms [2], P=0.4077 s [4]; $\dot{\mathrm{P}}$=4.02$\times10^{-12}$ [4]; τ=1.6$\times10^3$ yr [2]; DM=713 pc/cm^3 [2], DM=707 pc/cm^3 [4]; V=500 km/s if β=0.14 [1]; V$\leq$500 km/s at d=5 kpc [6]; $\Delta\theta$=1$'$ [6]; Log L_{1400}=1.653 [4]; $\dot{\mathrm{E}}$=2.3$\times10^{36}$ erg/s [2]; B=4.1$\times10^{13}$ G [2]; N_{HI}=$9^{+5}_{-3}\times10^{21}$ cm^{-2} [8]; Γ=$2.2^{+0.6}_{-0.3}$ [8], $\Gamma_{PSR}\geq$2.2 [8], $\Gamma_{PWN}\leq$2.2 [8]; Norm_{1keV}=($3.1^{+3.3}_{-1.5}$)$\times10^{-5}$ photons keV^{-1}cm^{-2}s^{-1} [8]; F(absorbed)=$6.6^{+13.4}_{-4.8}$)$\times10^{-14}$ erg/cm^{2}s (0.5-10 keV) [8], F(unabsorbed)=$1.3^{+2.4}_{-0.8}$)$\times10^{-13}$ erg/cm^{2}s (0.5-10 keV) [8], F(unabsorbed)=$1.4^{+2.6}_{-0.8}$)$\times10^{-13}$ erg/cm^{2}s (0.2-2.4 keV) [8]; $\mathrm{L}_x/\dot{\mathrm{E}}$(PSR+PWN)$\leq$0.001 [8]; braking index = 2.91 [8].

Remarks: No PWN has been found near the pulsar [1].

Hard X-ray source AX J1119.1-6128.5 has been found 1.5$'$ apart from this pulsar [3]. X-ray luminosity of this source is (0.4-3.2)$\times10^{33}$ erg/s in 0.1-2.4 keV and 0.5-10 keV bands if the distance is 5 kpc [3].

No pulsations are detected at the radio period with a pulsed fraction upper limit of 61% (95% confidence) [3].

The pulsar in the SNR must be at 5 kpc [3]. Taking this distance and age of the pulsar into account, the expansion velocity of the SNR V=6.2$\times10^3$ km/s [3].

The physical connection between the PSR and the SNR is certain [5].

A faint 3$''\times$6$''$ PWN at energies above $\sim$1.2 keV [8].

The X-ray emission from the PSR and its associated nebula is well described by an absorbed power law model with a photon index Γ=$2.2^{+0.6}_{-0.3}$. The corresponding 0.5-10 keV unabsorbed X-ray luminosity is ($5.5^{+10}_{-3.3}$)$\times10^{32}$ erg/s (at 6 kpc) [8].

When compared to two other pulsars with similar spin and magnetic properties, J1119-6127 stands out as being the least efficient at turning rotational kinetic energy into X-ray emission [8].

The PWN is not observable in the radio band [8].

[1] Crawford et al. 2001; [2] Camilo et al. 2000; [3] Pivovaroff et al. 2001; [4] Guseinov et al. 2004b; [5] Manchester et al. 2002; [6] Crawford et al. 2002a; [7] Lorimer 2003; [8] Gonzalez and Safi-Harb 2003b.

G293.8+0.6 (C, α=0.6?, θ=20, F=5?, Σ=1.88$\times10^{-21}$)

d=7.0 kpc (Σ-D), d=7 kpc adopted.

G294.1-0.0 (S, α=?, θ=40, F>2?, Σ>1.88$\times10^{-22}$)

d=4 kpc adopted.

G296.1-0.5 (S, α=0.6?, θ=37$\times$25, F=8?, Σ=1.30$\times10^{-21}$)

d=4.9 kpc (Σ-D), d=4.9 kpc adopted.

G296.5+10.0 (PKS 1209-51/52, S, α=0.5, θ=90$\times$65, F=48, Σ=1.23$\times10^{-21}$)

d=1.5 kpc [1,2], d=1-2 kpc [3], d=2.1 kpc [5], d=2.0 kpc (Σ-D), d=1.8 kpc adopted.

N_HI=1.4$\times10^{21}$ cm^{-2} [4], N_HI=(1.1-1.6)$\times10^{21}$ cm^{-2} [5]; A_V(r)=0.5$^\mathrm{m}$ [6]; n=0.1-0.2 cm^{-3} (the average in front) [9], n=10 cm^{-3} (for the HI clouds) [5]; t=2$\times10^4$ yr [7], t=7$\times10^3$ yr [1,3,8], t=10^4 yr [9], t=3-20 kyr [13]; E=2$\times10^{50}$ erg [9], E=6$\times10^{50}$ erg (d=1-2 kpc)

[4], $E>2\times10^{49}$ erg [5].

Remark: Mass of the neutral hydrogen in the SNR is more than 1900 $M_\odot$ (d=1-2 kpc) [5].

Point Source DRQNS 1E 1207.4-5209 [2,5]

$\Delta\theta=6'$ [2]; $\beta=0.1$-0.2 [1,3,4,8], $\beta=0.1$ [1,3,8]; P=0.42413 s [10]; $\dot{P}=(0.7$-$3)\times10^{-14}$ [11], $\dot{P}=1.98\times10^{-14}$ [12]; $\tau=200$-1600 kyr [11], $\tau=340$ kyr [12]; d=2 kpc [9], d=1.5 kpc [9], d=1.6-3.3 kpc [14], d=2.1 kpc [5,15]; $m_V>25$ [5,9], $m_V>23.5$ [2]; $N_{HI}=4\times10^{20}$ cm^{-2} (0.1-10 keV) [9], $N_{HI}=4\times10^{20}$ cm^{-2} (0.1-2.4 keV) [2], $N_{HI}=(0.7$-$2.2)\times10^{21}$ cm^{-2} [14], $N_{HI}=(1.1$-$1.6)\times10^{21}$ cm^{-2} [5], $N_{HI}=5\times10^{21}$ cm^{-2} [15]; $F_x=2.2\times10^{-12}$ erg/cm^{2}s (0.1-10 keV) [9], $F_x=2.25\times10^{-12}$ erg/cm^{2}s (0.1-2.4 keV) [2], $F_x=2.2\times10^{-12}$ erg/cm^{2}s (0.2-5 keV) [10], $F_x=1.9\times10^{-12}$ erg/cm^{2}s (0.5-6 keV) [15]; $F_{4800}<0.1$ mJy [2,9]; $F_{436}<1$ mJy [1,8], $F_{843}<3$ [3]; kT=0.28 keV (0.1-10 keV) [9], kT=0.25 keV (0.1-10 keV) (3×10^6 K) [2], kT=0.29 keV [13]; SI=3.9 (0.1-2.4 keV) [2], SI=5.1 (0.5-6 keV) [15]; V=200 km/s (the component of the velocity projected on the sky) [1,3,8]; $L_x=10^{33}$ erg/s (0.5-2.2 keV) [9], $L_x=5\times10^{32}$ erg/s (0.4-2.4 keV) if d=1.5 kpc [2], $L_x\sim3.5\times10^{33}$ erg/s [10], $L_x\sim8\times10^{33}$ erg/s (0.5-6 keV) [15]; Log $L_{4800}<-0.4$, Log $L_{436}<0.6$.

Remarks: There is a hole in the HI clouds at the center of the SNR and the neutron star is located there. This shows that the connection between the neutron star and the SNR is real [5].

The neutron star is near the center of the SNR. No synchrotron radiation has been observed from the near neighbourhood of the neutron star [9].

A new 424 ms (radio-quiet) X-ray pulsar has been discovered with Chandra observations of SNR PKS 1209-52 [10].

The pulse fraction values for this pulsar are: <24% [8,9] and 9% [15].

[1] Kaspi et al. 1996; [2] Mereghetti et al. 1996; [3] Roger et al. 1988; [4] Kellett et al. 1987; [5] Giacani et al. 2000; [6] Ruiz 1983; [7] Seward and Wang 1988; [8] Brazier and Johnston 1999; [9] Vasisht et al. 1997; [10] Zavlin et al. 2000; [11] Sanwal et al. 2002; [12] Mereghetti et al. 2002; [13] Pavlov et al. 2002a; [14] Zavlin et al. 1998; [15] Pavlov et al. 2002b.

G296.8-0.3 (1156-62, S, $\alpha=0.6$, $\theta=20\times14$, F=9, $\Sigma=4.84\times10^{-21}$)

d=9.6±0.6 kpc (HI absorption) [1], d~10 kpc [2], d=6.8 kpc (Σ-D), d=6.8 kpc adopted.

$t=(2$-$10)\times10^3$ yr [1], $t=(10\pm2)\times10^3$ yr [3]; $M_s\sim500n_0$ $M_\odot$ (n_0 ambient density); B=1.7±0.3 μG [1].

Remarks: SNR G296.8-0.3 was detected in X-rays with ROSAT PSPC [2].

A lower limit on the linearly polarized flux density from the SNR of 35±5 mJy and a fractional polarization of 0.5% (instrumental polarization contributes less than 0.1%) were estimated [1].

Free expansion at $(0.3$-$1.0)\times10^4$ km/s gives an age in the range 1600-6000 yr [1].

[1] Gaensler et al. 1998a; [2] Hwang and Markert 1994; [3] Frail et al. 1994.

G298.5-0.3 (?, $\alpha=0.4$?, $\theta=5$?, F=5?, $\Sigma=3.01\times10^{-20}$)

d=10.7 kpc (Σ-D), d=11 kpc adopted.

G298.6-0.0 (S, $\alpha=0.3$, $\theta=12\times9$, F=5?, $\Sigma=6.97\times10^{-21}$)

d=9.4 kpc (Σ-D), d=9.4 kpc adopted.

G299.2-2.9 (S, α=?, $\theta=18\times11$, F=0.5?, $\Sigma=3.8\times10^{-22}$)

d=0.5 kpc [1], d=13 kpc (Σ-D), d=12 kpc adopted.

$N_{HI}\sim3\times10^{20}$ cm^{-2} [1]; $T=8\times10^6$ K [1]; $L_x\sim10^{33}$ erg/s [1]; $n_0=0.2$ cm^{-3} [1]; t~560 $d_{0.5}$ yr [1]; $E=1.2\times10^{50}$ erg [1].

[1] Slane et al. 1996.

G299.6-0.5 (S, α=?, $\theta=13$, F=1.0?, $\Sigma=8.91\times10^{-22}$)

d=12.2 kpc (Σ-D), d=12 kpc adopted.

G301.4-1.0 (S, α=?, $\theta=37\times23$, F=2.1?, $\Sigma=3.71\times10^{-22}$)

d=6.3 kpc (Σ-D), d=6.3 kpc adopted.

G302.3+0.7 (S, $\alpha=0.4$?, $\theta=17$, F=5?, $\Sigma=2.60\times10^{-21}$)

d=7.8 kpc (Σ-D), d=7.8 kpc adopted.

G304.6+0.1 (Kes 17, S, $\alpha=0.5$, $\theta=8$, F=14, $\Sigma=3.29\times10^{-20}$)

d=6.5 kpc (Σ-D), d=6.5 kpc adopted.

G308.1-0.7 (S, α=?, $\theta=13$, F=1.2?, $\Sigma=1.07\times10^{-21}$)

d=11.9 kpc (Σ-D), d=11 kpc adopted.

G308.8-0.1 (C?, $\alpha=0.4$?, $\theta=30\times20$?, F=15?, $\Sigma=3.76\times10^{-21}$)

d=5.1 kpc (Σ-D), d=7.5 kpc adopted.

Point Source J1341-6220

d=8 kpc [1]; $\beta=0.39$ [2], $\beta=0.4$ [3]; DM=717 pc/cm^3 [1]; Log $L_{1400}=2.107$ [1]; P=0.1933 s [1]; $\dot{P}=2.53\times10^{-13}$ [1]; Log $\tau=4.08$ [1].

[1] Guseinov et al. 2004b; [2] Lorimer et al. 1998; [3] Allakhverdiev et al. 1997.

G309.2-0.6 (S, $\alpha=0.4$?, $\theta=15\times12$, F=7?, $\Sigma=5.85\times10^{-21}$)

d=4±2 kpc [1]; d=5.4±1.6 kpc [2]; d=7.8 kpc (Σ-D), d=6 kpc adopted.

kT~0.5 keV [1], kT=2 keV [1]; t=0.7-2 kyr [1]; $n_0=0.02$ cm^{-3} [1]; $N_{HI}=7\times10^{21}$ cm^{-2} [1].

Remark: The Si, S and Ar abundances are 3-10 times those of the Sun [1].

[1] Rakowski et al. 2001; [2] Gaensler et al. 1998b.

G309.8-2.6

Remark: The radius of the SNR is 25 pc [1].

G309.8-2.6 is possibly a SNR [2].

Point Source PSR J1357-6429

d=4 kpc [1]; P=166 ms [1]; $\tau=7.3$ kyr [1] Remarks: The PSR and the SNR are possibly connected [1].

An ATCA image shows the bright feature southwest of the PSR position and weaker emission to the north, but no obvious connection to the PSR [1].

[1] Manchester et al. 2002; [2] Duncan et al. 1997.

G309.8+0.0 (S, $\alpha=0.5$, $\theta=25\times19$, F=17, $\Sigma=5.39\times10^{-21}$)

d=5.0 kpc (Σ-D), d=5 kpc adopted.

G310.6-0.3 (Kes 20B, S, α=?, θ=8, F=5?, $\Sigma=1.18\times10^{-20}$)
d=9.9 kpc (Σ-D), d=10 kpc adopted.

G310.8-0.4 (Kes 20A, S, α=?, θ=12, F=6?, $\Sigma=6.27\times10^{-21}$)
d=8.5 kpc (Σ-D), d=8.5 kpc adopted.

G311.5-0.3 (S, α=0.5, θ=5, F=3?, $\Sigma=1.81\times10^{-20}$)
d=13.2 kpc (Σ-D), d=12 kpc adopted.

G312.4-0.4 (S, α=0.36, θ=38, F=45, $\Sigma=4.69\times10^{-21}$)
d=2 kpc [1], d=3.0 kpc (Σ-D), d=3 kpc adopted.
Remarks: The radius of this SNR is 8 pc [1].
G312.4-0.4 is a ring-shaped SNR with two bright regions connected by a bridge of emission [2]. PSR J1413-6141 lies on this bridge of emission, approximately midway between the two bright regions. This gives the system a morphology very similar to that of PSR B1509-58 - SNR G320.4-1.2 [3,4] and PSR B1338-62 - SNR G308.8-0.1 [5] and suggests that collimated winds from the PSR may be responsible for the bright regions [1].

Point Source PSR J1413-6141
β=0.35 [1]; d=2 kpc [1]; P=285 ms [1]; τ=14 kyr [1]; Remark: The PSR and the SNR are probably connected [1].

[1] Manchester et al. 2002; [2] Whiteoak and Green 1996; [3] Manchester 1987; [4] Gaensler et al. 1999; [5] Kaspi et al. 1992.

G312.5-3.0 (S, α=?, θ=18×20, F=3.5?, $\Sigma=1.46\times10^{-21}$)
d=7.7 kpc (Σ-D), d=7.7 kpc adopted.

G313.4+0.2
Remark: The radius of the SNR is 33 pc [1].

Point Source PSR J1420-6048
β=0.2 [1]; d=8 kpc [1]; P=68 ms [1]; τ=13 kyr [1]; Remarks: The PSR and the SNR are probably connected [1].
PSR J1420-6048 lies within and has been associated with a complex region of radio and X-ray emission sometimes known as the Kookaburra [2,3]. The PSR lies between the two most prominent emission features, both of which have a distorted ring shape. It is possible that this is another example of a bi-annular SNR morphology [1].

[1] Manchester et al. 2002; [2] D'Amico et al. 2001; [3] Roberts et al. 2001.

G315.4-2.3 (RCW 86, S, α=0.6, θ=42, F=49, $\Sigma=4.18\times10^{-21}$)
d=1 kpc [1], d=2.8 kpc [2,6], d=2.5 kpc [3,4,14], d=2.9 kpc (Σ-D), d=2.7 kpc adopted.
$N_{HI}=(1\text{-}4)\times10^{21}$ cm^{-2} [2,5], $N_{HI}=3\times10^{21}$ cm^{-2} [14]; SI=2.3 [14]; $F_x=3.7\times10^{-12}$ erg/cm^{2}s (0.7-10 keV) [14]; V=800 km/s [6,7], V=600 km/s [15], V=800 km/s (shock) [7], V=400-900 km/s [16], V=580-660 km/s [22]; n_0=0.2 cm^{-3} (the average in front of the SNR), n=10 cm^{-3} (in the clouds) [6], n=0.2 cm^{-3} (the average in front of the SNR) [16], n=0.3 cm^{-3} (the average in front of the SNR) [7]; t=9.5×10^3 yr [6]; E=6.6×10^{50} erg [6]; V_s=562 km/s (from spectroscopic H_α observations) [20], V_s=580-660 km/s (from models) [20].
Remarks: The SNR is located in the OB association at d=2.5 kpc [7].
The mechanism for the X-ray emission of the SNR is synchrotron radiation and there is a break at (2-4)×10^{16} Hz in the spectrum [7].
The radio-bright parts of the SNR are bright also in the X-ray [7].
X-ray synchrotron emission has been observed [7,8,9].
It is known that the electrons have been accelerated up to 10^{13}-10^{15} eV [12,13].
Power-law X-ray radiation has been observed from the SNRs SN 1006 and G347.3-0.5 without any lines in the spectra [10,11].
Non-thermal high energy emission have also been observed from the SNRs Cas A, IC443, Tycho, Kepler, G156.2+5.7 and G315.4-2.3 (RCW 86). RCW 86 was claimed to be the remnant of the supernova explosion in 185 AD, but [18] shows that age of the SNR is 8000 years. This SNR is in an OB association. Since the O, Ne, Mg and Si abundances are higher than the Fe abundance, this SNR must have been occured due to type-II supernova explosion [14].
The electrons have been accelerated up to 20 TeV [14].
This SNR's morphology is similar to the morphology of SNR Tycho. The SNRs Tycho, Kepler and SN 1006 have expansion velocities in the range 1500-2300 km/s. For this SNR the expansion velocity is 600 km/s since its age is larger. The SNR has expanded within a cavity and it seems that it is expanding in the boundary of the cavity and this leads to its velocity being dropped fastly [15].
In the direction of this SNR, there is Cir OB1 association (l = 315.°5, b = -2.°75) [19] at 2.5 kpc.
Balmer-dominated shock has been detected in SNR RCW 86 [22].

Point Source ?
kT=0.070±0.003 keV [21]; $N_{HI}=(9.2\pm3.4)\times10^{21}$ cm^{-2} [21]; L=6.7×10^{31} erg/s (0.5-10 keV) [21], L=1.12×10^{34} erg/s (bolometric) [21]; SI=2.31±0.30 [21].
Remarks: An X-ray source was found 7′ away from the center of the SNR. But optical emission with V$\sim14^m$ has been observed from a direction 3″ away from the direction of this source. This X-ray source is either an optical star or a neutron star [17].
Two point X-ray sources have been discovered; one of the sources has an optical counterpart with the photographic magnitude 13.38±0.40 and this source is interpreted as a foreground active star of late spectral type. The second source has no optical counterpart to a limiting magnitude ∼21. This source is interpreted as a candidate stellar remnant (neutron star), while the photon index and nonthermal luminosity of the source, which is the same as those of the Vela pulsar and PSR J0205+6449 in the SNR 3C 58, suggest that it can be a young 'ordinary' pulsar [21].

[1] Greidanus and Strom 1990; [2] Petruk 1999; [3] Braun et al. 1989; [4] Green 2004; [5] Nugent et

al. 1984; [6] Rosado et al. 1996; [7] Borkowski et al. 2001; [8] Allen et al. 1998; [9] Asvarov et al. 1990; [10] Koyama et al. 1997; [11] Slane et al. 1999; [12] Tanimori et al. 1998; [13] Muraishi et al. 2000; [14] Bamba et al. 2000; [15] Dickel et al. 2001; [16] Long and Blair 1990; [17] Vink et al. 2000; [18] Schaefer 1995; [19] Blaha and Humphreys 1989; [20] Ghavamian et al. 2001; [21] Gvaramadze and Vikhlinin 2003; [22] Sollerman et al. 2003.

G315.4-0.3 (?, $\alpha=0.4$, $\theta=24\times13$, F=8, $\Sigma=3.86\times10^{-21}$)
d=7.0 kpc (Σ-D), d=7 kpc adopted.

G315.9-0.0 (S, $\alpha=?$, $\theta=25\times14$, F=0.8?, $\Sigma=3.44\times10^{-22}$)
d=10 kpc (Σ-D), d=10 kpc adopted.

G316.3-0.0 (MSH 14-57, S, $\alpha=0.4$, $\theta=29\times14$, F=20?, $\Sigma=7.41\times10^{-21}$)
d=4.7 kpc (Σ-D), d=4.7 kpc adopted.

G317.3-0.2 (S, $\alpha=?$, $\theta=11$, F=4.7?, $\Sigma=5.85\times10^{-21}$)
d=9.5 kpc (Σ-D), d=9.5 kpc adopted.

G318.2+0.1 (S, $\alpha=?$, $\theta=40\times35$, F>3.9?, $\Sigma=>4.19\times10^{-22}$)
d=4 kpc adopted.

G318.9+0.4 (C, $\alpha=0.2?$, $\theta=30\times14$, F=4?, $\Sigma=1.43\times10^{-21}$)
d=7.2 kpc (Σ-D), d=7.2 kpc adopted.

G320.4-1.2 (RCW 89, C, $\alpha=0.4$, $\theta=35$, F=60?, Nitrogen-rich, $\Sigma=7.37\times10^{-21}$)
d=3.6 kpc [1], d=4 kpc [2], d=5.2 kpc (21 cm HI line) [3], d=5.2 kpc [4], d=4 kpc [11], d=2.7 kpc (Σ-D), d=4.2 kpc adopted.

$N_{HI}=9\times10^{21}$ cm^{-2} [5], $N_{HI}=9.5\times10^{21}$ cm^{-2} [6], $N_{HI}=6\times10^{21}$ cm^{-2} [7]; kT=0.67 keV [7], kT=0.4 keV (0.5-4 keV) [10], kT=1.1 keV (0.2-4 keV) [1], kT=10.9 keV (1.2-19.7 keV) [14]; SI=2.04 (1.2-19.7 keV) [14]; T=1.3×10^{7} K [1], T=4×10^{6} K [10]; $L_x=2.3\times10^{35}$ erg/s (0.2-4 keV) if d=3.6 kpc [1], $L_x\geq2\times10^{34}$ erg/s (0.1-2.4 keV) if d=4.2 kpc [6], $L_x\sim3.9\times10^{36}$ erg/s (0.2-2.4 keV) if d=4.2 kpc [7]; n=100 cm^{-3} (in the X-ray radiative region) [1]; t>270 yr [1], t$\sim10^{4}$ yr [7], t=1.7×10^{3} yr [11,12]; E=(10-20)$\times10^{50}$ erg [4]; $V_{expa}=14000$ km/s [4], $V_s\sim11500$ km/s [15]; B$\sim8\times10^{-6}$ G (in the plerionic part) [10].
Remarks: SNR G320.4-1.2 was formed in a supernova of high kinetic energy or low ejected mass which occured near the edge of a low density cavity [4].
It may be true that M=28 $M_\odot$ [10].

Point Source PSR J1513-5908 [8,9] radio and X-ray pulsar
d=4.2-4.4 kpc [9], d=4.2 kpc [8]; d$\sim$5 kpc [16]; $\beta=0.24$ [13]; DM=253 pc/cm^3 [8]; $N_{HI}=5.9\times10^{21}$ cm^{-2} [11]; kT=0.39 keV [11]; Log $L_{1400}=1.246$ [8]; P=0.1507 s [8,16]; $\dot{P}=1.54\times10^{-12}$ [8,16]; Log $\tau=3.19$ [8], Log $\tau=3.23$ [16]; $\dot{E}=1.8\times10^{37}$ erg/s [16]; B=1.5×10^{13} G [16]; $N_{HI}\sim10^{22}$ cm^{-2} [16]; SI(PSR)$\sim$1.4(?) [16], SI(PWN)$\sim$2.05 [16], SI(PWN)=1.93$\pm$0.03 [17], SI(pulsed+unpulsed)=1.40$\pm$0.50 [17], SI(pulsed)=1.26$\pm$0.08 [17]; braking index = 2.8 [16]; $L_x/\dot{E}$(PSR)>0.001 [16], $L_x/\dot{E}$(PWN)$\sim$0.009 [16].
Remarks: Jet has been found [11,12].
PWN has been observed both in radio and X-ray [16].

[1] Braun et al. 1989; [2] Allakhverdiev et al. 1986; [3] Green 2004; [4] Gaensler et al. 1999; [5] Seward et al. 1984; [6] Greiveldinger et al. 1995; [7] Trussoni et al. 1996; [8] Guseinov et al. 2003; [9] Taylor et al. 1996; [10] duPlessis et al. 1995; [11] Tamura et al. 1996; [12] Vasisht et al. 1996; [13] Lorimer et al. 1998; [14] Asaoka and Koyama 1990; [15] Crawford et al. 2002; [16] Gaensler et al. 2002; [17] Gotthelf 2003.

G320.6-1.6 (S, $\alpha=?$, $\theta=60\times30$, F=?, $\Sigma=?$)

G321.9-1.1 (S, $\alpha=?$, $\theta=28$, F>3.4?, $\Sigma>6.53\times10^{-22}$)
d=5 kpc adopted.

G321.9-0.3 (S, $\alpha=0.3$, $\theta=31\times23$, F=13, $\Sigma=2.74\times10^{-21}$)
d=4.9 kpc (Σ-D), d=4.9 kpc adopted.

G322.5-0.1 (C, $\alpha=0.4$, $\theta=15$, F=1.5, $\Sigma=1.00\times10^{-21}$)
d=10.4 kpc (Σ-D), d=10 kpc adopted.
Remark: The radius of the SNR is 48 pc [1].

Point Source PSR J1524-5706
$\beta=0.9$ [1]; d=22 kpc [1]; P=1116 ms [1]; $\tau=50$ kyr [1].
Remarks: PSR J1524-5706 lies near the edge of the SNR G322.5-0.1 [2]. While the implied PSR velocity is reasonable, this SNR has what appears to be a central plerion component, which probably contains the associated PSR. Therefore, PSR J1524-5706 is unlikely to be associated with this SNR [1].

[1] Manchester et al. 2002; [2] Whiteoak and Green 1996.

G323.5+0.1 (S, $\alpha=0.4?$, $\theta=13$, F=3?, $\Sigma=2.67\times10^{-21}$)
d=10.2 kpc (Σ-D), d=10 kpc adopted.

G326.3-1.8 (MSH 15-56, C, α-varies, $\theta=38$, F=145, $\Sigma=1.51\times10^{-20}$)
d=3.7 kpc [1], d=4.1 kpc [2], d=1.9 kpc (Σ-D), d=2 kpc adopted.
$\alpha=-0.29$ (for the whole SNR), $\alpha=-0.18$ (for the plerionic part) [3]; $N_{HI}=8.9\times10^{21}$ cm^{-2} [1]; $F_1=114$ Jy [3], F=26 Jy (for the plerionic part) [3]; kT=0.56 keV [1], T=4×10^{6} K [1]; Σ(1 GHz)=7.8×10^{-20} Wm^{-2}Hz^{-1}sterad^{-1} (for the plerionic part) [3], $\Sigma=1.23\times10^{-20}$ Wm^{-2}Hz^{-1}sterad^{-1} [3]; $L_x=6.1\times10^{35}$ erg/s (0.1-2.4 keV) [1]; $n_0=0.1$ cm^{-3} (the average in front of the SNR) [1]; $E_k=10^{51}$ erg [1]; t=10^{4} yr [1]; B=4.5×10^{-5} G (for the shell) [3].
Remarks: Radio-bright plerionic part of the SNR is $\sim$1/3 of the radius far away from the center [3].
The plerionic part constitutes 4% of the area of the SNR and the radiation coming from the plerionic part is 20% of the total radiation coming from the SNR [3].
Although, the plerionic part is large and bright, it is not observable in X-ray and optical bands [3].

Point Source ?

There must be a pulsar at the center of the plerionic part and, since it has gone 6 pc in 1.5×10^4 years, its speed must be 500 km/s [3].

[1] Kassim et al. 1993; [2] Rosado et al. 1996; [3] Dickel et al. 2000.

G327.1-1.1 (C, α=?, θ=18, F=7?, $\Sigma=3.25\times10^{-21}$)

d=6.5 kpc [1], d=6.5±1 kpc [2], d=9 kpc [4], d=7.1 kpc (Σ-D), d=6.5 kpc adopted.

$N_{HI}=1.3\pm0.4\times10^{22}$ cm^{-2} [1], $N_{HI}=(1.8\pm0.3)\times10^{22}$ cm^{-2} [4]; kT=0.8±0.3 keV [1], kT∼0.18 keV (for the hot plasma) [3], $kT=0.37^{+0.35}_{-0.20}$ [4]; SI∼2.2 (for the plerion) [3]; $L_x=1.5\times10^{35}$ erg/s (0.2-2.4 keV) [1], L(1 GHz)=$6.2\times10^{32}d^2_{10kpc}$ erg/s [3]; $t=7\times10^3$ yr [1], $t/d_{10kpc}=(2.6\text{-}3.3)\times10^4$ yr (Sedov model) [3], $t/d_{10kpc}=(1.2\text{-}2.1)\times10^4$ yr (WL model [5]) [3], $t=1.1\times10^4$ yr [4]; $E\sim1.3\times10^{51}$ erg [1]; V=304-430 km/s (Sedov model) [3], V=470-790 km/s (WL model [5]) [3]; $Ed^{-5/2}_{10kpc}=(0.3\text{-}6.2)\times10^{51}$ erg (Sedov model) [3], $Ed^{-5/2}_{10kpc}=(0.7\text{-}25.1)\times10^{51}$ erg (WL model [5]) [3]; $M_xd^{-5/2}_{10kpc}=220\text{-}2910\ M_\odot$ (Sedov model, $M_x=M_{tot}$) [3], $M_xd^{-5/2}_{10kpc}=320\text{-}4000\ M_\odot$ (WL model [5]) [3]; $n_0d^{1/2}_{10kpc}=0.10\text{-}1.35$ cm^{-3} (Sedov model) [3], $n_0d^{1/2}_{10kpc}=0.02\text{-}0.41$ cm^{-3} (WL model [5]) [3].

Remarks: The X-ray emission of the remnant is a sum of two components: a non-thermal component due to the pulsar nebula and the pulsar itself, and a thermal component of which the spectrum and morphology have been analysed after subtracting the plerionic part [3]. No pulsation at the 99% confidence limit with an upper limit at the same level of confidence of 19.4% in the 0.1-256 Hz range [3].

The radiative model implies a very long age (greater than or approximately equal to 30000 yr) and in this case the observed offset of the associated pulsar may be accounted for without requiring a too high spatial velocity for it [3].

[1] Seward et al. 1996; [2] Crawford et al. 2002b; [3] Bocchino and Bandiera 2003; [4] Sun et al. 1999; [5] White and Long 1991.

G327.4+0.4 (Kes 27, S, α=0.6, θ=21, F=30?, $\Sigma=1.02\times10^{-20}$)

d=6.5 kpc [1], d=4.0 kpc (Σ-D), d=5 kpc adopted.

$N_{HI}=1.3\times10^{22}$ cm^{-2} [1]; kT=3.2±1.5 keV [1]; $L_x=1.5\times10^{35}$ erg/s (0.2-2.4 keV) [1]; $t=3.5\times10^3$ yr [1]; $E=1.1\times10^{51}$ erg [1].

[1] Seward et al. 1996.

G327.4+1.0 (S, α=?, θ=14, F=1.9?, $\Sigma=1.46\times10^{-21}$)

d=10.5 kpc (Σ-D), d=10 kpc adopted.

G327.6+14.6 (SN 1006, S, α=0.6, θ=30, F=19, $\Sigma=3.18\times10^{-21}$)

d=0.7±0.1 kpc (from Sedov model) [1], d=1.5-2.5 kpc [8], d=1.7-3.1 kpc [4], d=2 kpc [7], d=1.8±0.3 kpc [2,3,4], d=4.3 kpc (Σ-D), d=2 kpc adopted.

$N_{HI}=(3.9\text{-}5.7)\times10^{20}$ cm^{-2} [1], $N_{HI}=1.8\times10^{21}$ cm^{-2} [9]; $A_V=0.31$ [10]; $V=1.4\times10^3$ km/s (shock) [1], $V=1.66\times10^3$ km/s [5,6,7], V=3000 km/s [17,19]; $n_0=0.4$ cm^{-3} (density of the ambient medium) [1], n=0.1 cm^{-3} (in front of the SNR) [16]; kT=7-10 keV (non-thermal X-ray) [18]; $E_k=2.4\times10^{49}$ erg [1], $E>4.4\times10^{49}$ erg [1], $E=10^{51}$ erg [16]; $B=(6\text{-}10)\times10^{-6}$ G [9], $B=(3\text{-}6)\times10^{-6}$ [16].

Remarks: The adopted distance (d=2 kpc) is less than half of the distance value found from the Σ-D relation (d(Σ-D)=4.3 kpc), because the SNR is expanding in a low-density medium ($n_0\sim0.02$ cm^{-3} [11]).

Average proper motion of the filaments seen in H_α is $0''.30\pm0''.04$ per year. Expansion velocities of these filaments are 2600±300 km/s [2,3,4].

Using the expansion velocity (16600 km/s) and the age values of this SNR its diameter is found to be 8.4 pc. Since, the angular diameter of SN 1006 is 30′, the lower limit for its distance must be 1.9 kpc [5,6,7].

The masses of Si and Fe in the Ia type SNR SN 1006 are less than 0.25 $M_\odot$ and 0.16 $M_\odot$, respectively [12].

The electrons are accelerated up to very high energies in the shock wave and they emit synchrotron radiation in X-ray band in young SNRs [13,14].

The mean expansion in 1983-1984 yr is 3.5±1 arcsec, implying an expansion rate of 0.049% yr^{-1} or $R\sim t^{0.48\pm0.13}$ [15].

TeV radiation has been observed from this SNR [9].

Balmer-dominated shock has been detected in SN 1006 [19].

[1] Willingale et al. 1996; [2] Long et al. 1988; [3] Roger et al. 1988; [4] Green 2004; [5] Fesen et al. 1988; [6] Wu et al. 1993; [7] Winkler and Long 1997; [8] Schaefer 1996; [9] Koyama et al. 1995; [10] Laming et al. 1996; [11] Kirshner et al. 1987; [12] Hamilton et al. 1997; [13] Asvarov et al. 1990; [14] Laming 1998; [15] Moffett et al. 1993; [16] Reynolds 1996; [17] Smith et al. 1991; [18] Ozaki et al. 1994; [19] Sollerman et al. 2003.

G328.4+0.2 (MSH 15-57, F, α=0.12, θ=5, F=15, $\Sigma=9.03\times10^{-20}$)

d=17.4 kpc (21 cm HI line) [1], d=17.4 kpc adopted.

$N_{HI}=8\times10^{22}$ cm^{-2} [2]; SI=2.9 [2]; kT=4 keV [2]; $n_0=0.003$ cm^{-3} (in front of the SNR) [1].

Remarks: The adopted distance d=17.4 kpc corresponds to a diameter D=25 pc.

This SNR's radio luminosity ($L_{rad}=3\times10^{35}$ erg/s) is greater than Crab SNR's radio luminosity ($L_{rad}=1.8\times10^{35}$ erg/s) and its diameter is larger than Crab SNR's diameter [1].

The SNR has a high luminosity in radio band similar to Crab, but its luminosity in X-ray band is 70 times less [2].

Crab-like SNRs G328.4+0.2 (MSH 15-57), G74.9+1.2 (D=25 pc, $L=7\times10^{34}$ erg/s) and N157B (D=24 pc, $L=3.5\times10^{35}$ erg/s, in Magellanic Cloud) have very low density ambient media [1].

Connection with a possible PSR

P<20 ms [1]; $\tau\cong7000$ yr [1]; $N_{HI}\sim3\times10^{22}$ cm^{-2} [2];

$F_x=6\times10^{-13}$ erg/cm^{2}s (2-10 keV) [2]; $B<10^{12}$ G [1].
Remarks: About 1/4 of the radio SNRs are observable in X-ray band; if kT value of a SNR is <2 keV then its radiation becomes very weak in the interstellar medium, but if kT≥4 keV then the SNR can be observable from all parts of the Galaxy [2].
X-ray emission has been detected from this Crab-like pulsar ($5'\times5'$ in size) which is beyond 17 kpc [2].
[1] Gaensler et al. 2000; [2] Hughes et al. 2000.

G329.7+0.4 (S, α=?, θ=40×33, F>34?, $\Sigma>3.88\times10^{-21}$)
d=3.3 kpc adopted.

G330.0+15.0 (Lupus Loop, S, α=0.5?, θ=180?, F=350?, $\Sigma=1.63\times10^{-21}$)
d=1.2 kpc [1], d=0.8 kpc (Σ-D), d=0.8 kpc adopted.
Remarks: The height from the Galactic plane corresponding to the distance value found from the Σ-D relation (d=0.8 kpc) is h=207 pc. Since, there is no star formation region around this SNR, its position in the Σ-D diagram can not be above the Σ-D line. So, the adopted distance for this SNR is 0.8 kpc.
[1] Leahy et al. 1991.

G330.2+1.0 (S?, α=0.3, θ=11, F=5?, $\Sigma=6.22\times10^{-21}$)
d=9.3 kpc (Σ-D), d=9.3 kpc adopted.

G332.0+0.2 (S, α=0.5, θ=12, F=8?, $\Sigma=8.36\times10^{-21}$)
d=7.5 kpc (Σ-D), d=7.5 kpc adopted.

G332.4-0.4 (RCW 103, S, α=0.5, θ=10, F=28, Nitrogen-rich, $\Sigma=4.21\times10^{-20}$)
d=4 kpc [9], d=3.3 kpc [2,19], d=4.7 kpc (Σ-D), d=3.7 kpc adopted.
$A_V=4.5^m$ [1]; $T=5\times10^6$ K (kT=0.43 keV) [8]; V_s=1200 km/s [11], $V\sim5\times10^3$ km/s [13], V_s>1100 km/s [15], V_s=1100 km/s [16], $V_s\sim$2500 km/s [21], V∼130 km/s (for the filaments) [16]; $L_x=8.8\times10^{36}$ erg/s (0.2-4 keV) if d=3.9 kpc [8]; MC [17]; n=1000 cm^{-3} (for the clouds) [8], $n_0\geq1000$ cm^{-3} (for the MC) [16]; t>480 yr [8], $t=(1\text{-}3)\times10^3$ yr [6,14], $t=10^3$ yr [11], $t=2\times10^3$ yr if d=3.3 kpc [15].
Remarks: The value of $A_V=4.5^m$ for the SNR is in accordance with the average A_V value of 6.3^m [3] for the stars at 3.4 kpc [2] in this direction.
The distance of this SNR is adopted as 3.3 kpc [4,5,6,7].
In the direction of RCW 103, there is R103 association at 4 kpc [8].
The angular radius of this SNR increased $1''.8\pm0''.2$ in 25 years [15].
RCW 103 has $N_{HI}=6.8\times10^{21}$ cm^{-2} [10] and this shows that RCW 103 may have a relation with R103 association. On the other hand, if RCW 103 is related to this association then it may possibly be expanding in a dense medium.
Density of the gas behind the shock wave is relatively low ($n_e\sim10^3$ cm^{-3}) [12].
This SNR has roughly a spherical shape. It is bright and has a thick shell. Northern part of the shell is interacting with a molecular cloud. It is possible that this SNR has been formed due to a supernova explosion 1000 years ago [13].

Point Source 1E 161348-5055 (X-ray) [19] and PSR J1617-5055 (radio) [22] pulsar
β=0.05 [6,14]; P=69 ms (X-ray pulse) [19]; $\dot{P}=1.4\times10^{-13}$ [19]; τ=8.1 kyr [19], τ=8 kyr [22], τ=1-3 kyr [23]; d=3.3 kpc [20]; SI=1.6 [19]; $F_x=6.4\times10^{-12}$ erg/cm^{2}s (3.5-10 keV) [19], $F_x=9.6\times10^{-13}$ erg/cm^{2}s (0.4-10 keV) [20], $F_x=7\times10^{-13}$ erg/cm^{2}s [5,14], $F_x=10^{-11}$ erg/cm^{2}s (0.5-9 keV) [24]; V=200 km/s [14]; $L_x=10^{33}$ erg/s (0.4-10 keV) if d=3.3 kpc [20], $L_x=1.3\times10^{33}$ erg/s (5-10 keV) [5]; $N_{HI}=(6.8\text{-}7.3)\times10^{21}$ cm^{-2} [10]; kT=0.6 keV (blackbody) [5], kT=0.4-0.7 keV (blackbody) [23,24]; $F_{1500}<0.1$ [6,14], $F_{436}<1.5$ [6,14]; R<24 [20].
Remarks: The pulse fraction values for this pulsar are: 50% [19] and 20-40% [20].
The pulse width values for this pulsar are: 5.8±0.6 ms (at 50% intensity) and 11±1 ms (at 10% intensity) [22].
If PSR J1617-5055 and SNR RCW 103 are associated, the implied proper motion of the pulsar would be ∼130 (3 kyr/τ) mas/yr, and the corresponding transverse velocity is ∼4200 (d/6.5 kpc) (3 kyr/τ) km/s [22].
Although the respective ages and distances of the pulsar and the SNR are consistent within error limits, the large inferred pulsar transverse velocity is difficult to explan given the observed pulsar velocity distribution, the absence of evidence for a PWN, and the symmetry of the SNR [22].
It seems that X-ray flux of the point source at the center of the SNR has changed 10 times in 4 years, but this is related with the measuring instrument and is not a real change related with the source [10,18].
A period of 5.97 hr was found in the X-ray radiation (90% confidence). From the analysis of the older data it seems that there may be a period of 6.3 hr. This point source may be a low mass X-ray binary with a very low luminosity [20].
[1] Oliva et al. 1990; [2] Caswell et al. 1975; [3] Neckel et al. 1980; [4] Tuohy and Garmire 1980; [5] Gotthelf et al. 1997; [6] Kaspi et al. 1996; [7] Green 2004; [8] Braun et al. 1989; [9] Allakhverdiev et al. 1986; [10] Gotthelf et al. 1999; [11] Nugent et al. 1984; [12] Oliva et al. 1999; [13] Dickel et al. 1996; [14] Brazier and Johnston 1999; [15] Carter et al. 1997; [16] Meaburn and Allan 1986; [17] Frail et al. 1996; [18] Petre et al. 1998; [19] Torii et al. 1998; [20] Garmire et al. 2000; [21] Crawford et al. 2002b; [22] Kaspi et al. 1998; [23] Pavlov et al. 2002a; [24] Pavlov et al. 2002b.

G332.4+0.1 (MSH 16-51, S, α=0.5, θ=15, F=26, $\Sigma=1.74\times10^{-20}$)
d=4.5 kpc (Σ-D), d=4 kpc adopted.

G335.2+0.1 (S, α=0.5, θ=21, F=16, $\Sigma=5.46\times10^{-21}$)
d=5.1 kpc (Σ-D), d=5 kpc adopted.

G336.1-0.2
Remark: The radius of the SNR is 35 pc [1].

Point Source PSR J1632-4818

β=0.15 [1]; d=8 kpc [1]; P=813 ms [1]; τ=20 kyr [1].

Remarks: The PSR and the SNR are probably connected [1].

PSR J1632-4818 is a 20 kyr old PSR which is located close to the center of the uncatalogued shell source G336.1-0.2. Although the region is complex, this shell source is likely to be a SNR associated with the PSR. The implied velocity of the PSR (250 km/s) and of the shell (1700 km/s) are both reasonable [1].

[1] Manchester et al. 2002.

G336.7+0.5 (S, α=0.5, θ=14×10, F=6, $\Sigma=6.45\times10^{-21}$)

d=8.5 kpc (Σ-D), d=8.5 kpc adopted.

G337.0-0.1 (CTB 33, S, α=0.6?, θ=1.5, F=1.5, $\Sigma=1.0\times10^{-19}$)

d=8.3-11.3 (21 cm HI line) [1,2], d=11 kpc [3,6], d=4.6 kpc or 11 kpc (21 cm HI line) [4], d=19.7 kpc (Σ-D), d=11 kpc adopted.

α=0.6 [3]; D=5 pc [3]; MS [1,6,8,9]; $t\leq2\times10^4$ yr [5].

Remarks: This SNR is in a region of HII regions and maser sources. Using a Galactic rotation model a distance of 11 kpc is found for them. The diameter of the SNR is 4.8 pc [6].

The SNR is interacting with a few clouds [1]. But the average density is not high.

[1] Frail et al. 1996; [2] Green 2004; [3] Sarma et al. 1997; [4] Fich et al. 1989; [5] Braun et al. 1989; [6] Corbel et al. 1999.

G337.2-0.7 (S, α=0.7, θ=6, F=2?, $\Sigma=8.36\times10^{-21}$)

d=10 kpc [1], d=15 kpc (Σ-D), d=12 kpc adopted.

$F_x=5\times10^{-13}$ erg/cm^{2}s (0.3-3.5 keV) [1]; $N_{HI}=3.5\times10^{22}$ cm^{-2} [1]; SI=1.3 [1]; kT=0.85 keV [1]; t=2-4.5 kyr [1].

Remark: The abundances of Si, S, and Ar are 3-5 times the ones in the Sun [1].

[1] Rakowski et al. 2001.

G337.3+1.0 (Kes 40, S, α=0.55, θ=15×12, F=16, $\Sigma=1.34\times10^{-20}$)

d=5.6 kpc (Σ-D), d=5.6 kpc adopted.

G337.8-0.1 (Kes 41, S, α=0.5, θ=9×6, F=18, $\Sigma=5.02\times10^{-20}$)

d=7.9-12.3 kpc (21 cm HI line) [1], d>9.3 kpc (21 cm HI line) [2], d=6 kpc (Σ-D), d=8 kpc adopted.

MC [1].

[1] Koralesky et al. 1998a; [2] Green 2004.

G338.1+0.4 (S, α=0.4, θ=15?, F=4?, $\Sigma=2.68\times10^{-21}$)

d=8.8 kpc (Σ-D), d=8.8 kpc adopted.

G338.3-0.0 (S, α=?, θ=8, F=7?, $\Sigma=1.65\times10^{-20}$)

d=8.6 kpc (Σ-D), d=8.6 kpc adopted.

G338.5+0.1 (?, α=?, θ=9, F=12?, $\Sigma=2.23\times10^{-20}$)

d=6.8 kpc (Σ-D), d=6.8 kpc adopted.

G340.4+0.4 (S, α=0.4, θ=10×7, F=5, $\Sigma=1.08\times10^{-20}$)

d=9.7 kpc (Σ-D), d=9.7 kpc adopted.

G340.6+0.3 (S, α=0.4?, θ=6, F=5?, $\Sigma=2.09\times10^{-20}$)

d=10.3 kpc (Σ-D), d=10.3 kpc adopted.

G341.2+0.9 (C, α=0.6?, θ=16×22, F=1.5?, $\Sigma=6.41\times10^{-22}$)

d=8.9 kpc (Σ-D), d=6.8 kpc adopted.

Point Source PSR J1646-4346

d=6.85 kpc [1], d=6.9 kpc [4]; β=0.7 [2]; RA(J2000)=$16^h46^m50^s.86\pm0^s.04$ [3], Dec(J2000)=-$43°45'53''.7\pm0''.8$ [3]; DM=490 pc/cm^3 [1]; Log L_{1400}=1.67 [1]; P=0.2316 s [1]; $\dot{P}=1.13\times10^{-13}$ [1]; Log τ=4.51 [1].

Remarks: For PSR J1646-4346 there is evidence of a 4′comet-shaped nebula, suggestive of a synchrotron "wake" left by a fast moving PSR [3].

The PSR is located within the shell of SNR G341.2+0.9, about 8′ west of the center of the remnant [3].

The characteristic age of the PSR together with its positional offset from the center of the SNR imply a transverse velocity of 475 km/s [3].

There is PWN [3].

[1] Guseinov et al. 2004b; [2] Frail et al. 1994; [3] Giacani et al. 2001; [4] Taylor and Cordes 1993.

G341.9-0.3 (S, α=0.5, θ=7, F=2.5, $\Sigma=7.68\times10^{-21}$)

d=13.3 kpc (Σ-D), d=13.3 kpc adopted.

G342.0-0.2 (S, α=0.4?, θ=12×9, F=3.5?, $\Sigma=4.88\times10^{-21}$)

d=10.8 kpc (Σ-D), d=10.8 kpc adopted.

G342.1+0.9 (S, α=?, θ=10×9, F=0.5?, $\Sigma=8.36\times10^{-22}$)

d=16.9 kpc (Σ-D), d=16.9 kpc adopted.

G343.0-6.0 (S, α=?, θ=250, F=?, Σ=?)

G343.1-2.3 (C?, α=0.5?, θ=32?, F=8?, $\Sigma=1.18\times10^{-21}$)

d=2.4-3.2 kpc (HI absorption) [2], d=2.1 kpc [4], d=3.1 kpc [11], d=4.7 kpc (Σ-D), d=4.7 kpc adopted.

α=0.5 [11]; t=5000-6000 yr [1,3], t=8900 yr [11]; B$\sim$3 μG [5]; F_{total}=30 Jy [11]; n=0.09 cm^{-3} (based on the PSR age) [11], n=0.02 cm^{-3} (based on the Sedov model age) [11]; F(absorbed)=3.4×10^{-13} erg/cm^{2}s (power-law, 0.5-8 keV) [13]; L(unabsorbed)=$3.1^{+1.5}_{-1.0}\times10^{32}$ erg/s (power-law, d=2.5 kpc, 0.5-8 keV) [13]; $N_{HI}=5.5^{+2.5}_{-2.1}\times10^{21}$ cm^{-2} [13]; SI=$1.34^{+0.24}_{-0.30}$ [13].

Remark: The expansion velocity of the blast wave is less than $\sim$500 km/s [4].

Point Source PSR 1709-4428 radio, X-ray and γ-ray pulsar [13]

d=2.8 kpc [1], d=2.4-3.2 kpc (HI absorption) [2]; d=2.1 kpc [4], d=2 kpc [5]; d=1.8 kpc [10,11], d=2.5 kpc [13]; RA(J2000)=$17^h9^m42^s.75\pm0^s.02$ [5], Dec(J2000)=-$44°29'6''.6\pm0''.5$ [5]; P=0.102449749380 s [1]; $\dot{P}=93.0400\times10^{-15}$ s/s [1]; DM=75.69 cm^{-3}pc [1,13]; S_{1400}=10 mJy [1]; L_{1400}=80 mJy kpc^2 [1]; B=3.12×10^{12} G [1]; τ=17450 yr [1]; F=10 mJy [11]; F(absorbed)=1.2×10^{-13} erg/cm^{2}s (power-law, 0.5-8 keV) [13]; L_x(blackbody)=$(5.4\text{-}7.1)\times10^{32}$ erg/s (presumably the PSR) [11], L_x(power-law)=$(7.6\text{-}9.9)\times10^{32}$

erg/s (PWN) [11], L(unabsorbed)=$1.45^{+0.46}_{-0.08}\times10^{32}$ erg/s (power-law, d=2.5 kpc, 0.5-8 keV) [13], L(bolometric)=$6.8^{+0.8}_{-1.1}\times10^{32}$ erg/s [13]; N_{HI}(pulsar)=5.5×10^{21} cm^{-2} [13]; T(blackbody)= $1.66^{+0.17}_{-0.15}\times10^{6}$ K [13]; SI=2.0±0.5 [13].

Remarks: The PSR lies on the edge of the SNR [1] and the two are physically associated [3].

If the association is real it implies a transverse speed of ∼1100 km/s for the PSR, but the PSR velocity is found to be only 27 km/s [1].

The existing observational data can be interpreted in favour of the physical association between PSR J1709-4428 and SNR G343.1-2.3 [4].

PSR J1709-4428 is a young PSR (spin-down age ∼17000 yr) [5].

The unpulsed emission is thought to originate from a compact synchrotron nebula of about 1′ in size around the PSR [6,7].

X-ray observations made with ROSAT, ASCA [7] and RXTE [8] confirm the lack of pulsations.

There is PWN [5].

For the PWN of PSR J1709-4428 α=0.25-0.3 [5].

The radio luminosity of the PWN between 10^7 and 10^{11} Hz is 7.6×10^{30} erg/s [5].

For the PWN B=20-60 μG [5].

The PWN extends up to 3′.5 [5].

The association between the PSR and the SNR was questioned based on distance inconsistencies, lack of morphological signatures of interaction between the PSR and the SNR, and scintillation measurements indicating a transverse velocity for the PSR at least 20 times smaller than required if the PSR originated in the geometrical center of the SNR 17000 years ago [1,9].

The connection between the PSR and the SNR is likely based on the evidence coming from the images of SNR G343.1-2.3 obtained using ATCA and the PSR obtained using the CHANDRA X-ray observatory [11].

An X-ray PWN has been found in the archived CHANDRA observations with the correct morphology to support the association [11].

The X-ray morphology points back toward the center of the SNR indicating the direction of the proper motion and that the PSR and the SNR are associated [11].

If the association of the PSR and the SNR is real, a transverse velocity of ∼900 km/s is required for the PSR to have moved from the approximate geometric center of the SNR in the characteristic time of 17 kyr [11].

The maximum value of the transverse velocity of the PSR is 100 km/s [12].

For the PWN the number density is ∼0.09 cm^{-3} [11].

Pulsed X-ray emission has been detected from the young, energetic radio and γ-ray pulsar [13].

The folded light curve has a broad, single-peaked profile with a pulsed fraction of 23%±6% [13].

A periodic signal at a frequency of 9.7588096779 Hz and a frequency derivative of -8.880796×10^{-12} Hz/s [13].

The blackbody radius at the nominal 2.5 kpc distance is only R=3.6±0.9 km, indicating either a hot region on a cooler surface, or the need for a realistic atmosphere model that would allow a lower temperature and larger area [13].

This pulsar has originally been detected as the high energy γ-ray source 2CG342-02 by the COS B satellite [14].

[1] Nicastro et al. 1996; [2] Koribalski et al. 1995; [3] McAdam et al. 1993; [4] Bock and Gvaramadze 2002; [5] Giacani et al. 2001; [6] Becker et al. 1995; [7] Finley et al. 1998; [8] Ray et al. 1999; [9] Frail et al. 1994; [10] Taylor and Cordes 1993; [11] Dodson and Golap 2002; [12] Johnston et al. 1998; [13] Gotthelf et al. 2002; [14] Swanenburg et al. 1981.

G343.1-0.7 (S, α=0.55, θ=27×21, F=7.8, $\Sigma=2.07\times10^{-21}$)

d=5.8 kpc (Σ-D), d=5.8 kpc adopted.

G344.7-0.1 (C?, α=0.5, θ=10, F=2.5?, $\Sigma=3.76\times10^{-21}$)

d=12.5 kpc (Σ-D), d=12.5 kpc adopted.

G345.7-0.2 (S, α=?, θ=6, F=0.6?, $\Sigma=2.51\times10^{-21}$)

d=22 kpc (Σ-D), d=18 kpc adopted.

G346.6-0.2 (S, α=0.5?, θ=8, F=8?, $\Sigma=1.88\times10^{-20}$)

d=5.5-11 kpc (21 cm HI line) [1], d=8.2 kpc (Σ-D), d=8.2 kpc adopted.

OH MS [1]; t=2×10^4 yr [2]; B=1.7±0.1 mG [1].

Remark: The shock wave is interacting with the molecular cloud (maser source) [1].

Point Source ?

β=1.7 [2].

Remarks: If the distance of the SNR is d=9-10 kpc, then the space velocity of the neutron star must be V=1000 km/s [2].

Since the β value is very large, the probability of a connection between the SNR and the point source is very small.

[1] Koralesky et al. 1998a; [2] Marsden et al. 1999.

G347.3-0.5 (S?, α=?, θ=65×55, F=?, Σ=?)

d≅1 kpc [1,4], d≅6 kpc [2,3,7], d=6±1 kpc [10], d=6 kpc adopted.

$N_{HI}=8\times10^{21}$ cm^{-2} [2,3]; kT=3.8±0.3 keV (nonthermal X-ray) [4]; t≅2000 yr (if d=1 kpc) [7], t∼10^4 yr (for d=6 kpc) [7].

Remarks: This SNR was first found by the ROSAT satellite [1] and then it was confirmed by the ASCA satellite.

SNR G347.3-0.5 is one of the brightest Galactic X-ray SNRs known with an X-ray flux density of 4.4×10^{-10} erg/cm^{2}s [1].

The spectrum is quite steep with a power law index Γ=2.8±0.2 between 400 GeV and 8TeV. The steep spectrum is inconsistent with the inverse Compton model, but could be explained by π^0-decay gamma-rays [5].

The derived hard power-law spectrum of synchrotron X-ray radiation of SNR RX J1713.7-3946 implies that the electron acceleration continues effectively to ≥100 TeV under strong magnetic field exceeding 100 μG. The acceleration also takes place in the low magnetic field region. Then, the electrons quickly escape from the acceleration region and enter into regions with significantly enhanced magnetic field. Another possibility would be that the electrons are of secondary ($\pi^{\pm}$-decay) origin, produced in interactions of accelerated protons and ions with the ambient gas. This hypothesis requires very strong magnetic field and acceleration of protons to energies $\geq 10^{15}$ eV [6].

$L_\gamma \sim 4\times10^{35}$ d_6^2 erg/s, by π^0-decay γ-rays the total energy of protons in this cloud should be close to 10^{50} d_6^2 erg [5,6].

No thermal line emission was detected from any portion of SNR G347.3-0.5 by previous studies [7].

The detection of non-thermal X-ray emission from this SNR has made G347.3-0.5 one of the prime examples of an SNR acting as an accelerator of cosmic-ray particles [7].

Emission from TeV photons located on the northwestern rim of G347.3-0.5 has been detected [9].

SNR G347.3-0.5 is one of the three shell-type SNRs besides SN 1006 and Cas A reported to produce TeV emission [7].

The ambient density surrounding the SNR is estimated to be $\sim$0.05-0.07 cm^{-3} [7].

According to [7], maximum energy of cosmic-ray electrons accelerated by the rims of SNR G347.3-0.5 is 19-25 TeV (assuming B=10 μG), consistent with the results of [8].

Fitting the broadband (radio to γ-ray) energy spectrum of SNR G347.3-0.5 with a synchrotron-inverse Compton scattering model yields a value of $8.8^{+4.1}_{-3.4}$ TeV for the maximum energy of the accelerated cosmic ray electrons and $B=150^{+250}_{-80}$ μG [7].

Point Source PSR J1713-3949 (Radio and X-ray(?) Pulsar) [7,10]

d=5.0±0.2 kpc [10]; P=392 ms [10]; $\tau\sim$100 kyr [10]; DM=337±3 pc/cm^3 [10]; .

Remarks: PSR J1713-3949 may be associated with SNR G347.3-0.5 [7].

PSR J1713-3949 is possibly associated with SNR G347.3-0.5 [10].

No X-ray pulsation has been detected at the measured radio period of 392 ms [7].

Radio pulsar PSR J1713-3949, which lies near the center of SNR G347.3-0.5, may be associated with the SNR [7].

The presence of X-ray pulsations from PSR J1713-3949 is not confirmed [7].

The positional coincidence of PSR J1713-3949 with 1WGAJ1713.4-3949 suggests an association with the SNR, but the uncertainty in the PSR's position is large ($\sim 7'$, the discovery beam radius). A timing solution for the PSR will provide arcsecond positional accuracy for the PSR as well as a more accurate age estimate. This will enable us to establish a more significant positional coincidence with 1WGAJ1713.4-3949 which can directly confirm or refute an association between PSR J1713-3949 and SNR G347.3-0.5 [10].

[1] Pfeffermann and Aschenbach 1996; [2] Slane et al. 1999; [3] Green 2004; [4] Koyama et al. 1997; [5] Enomoto et al. 2002; [6] Uchiyama et al. 2002; [7] Pannuti et al. 2003; [8] Ellison et al. 2001; [9] Muraishi et al. 2000; [10] Crawford et al. 2002b.

G348.5-0.0 (S?, α=0.4?, θ=10?, F=10?, $\Sigma=1.51\times10^{-20}$)

d=7.1 kpc (Σ-D), d=7.1 kpc adopted.

G348.5+0.1 (CTB 37A, S, α=0.3, θ=15, F=72, $\Sigma=4.82\times10^{-20}$)

d=10.2±3.5 kpc (21 cm HI line) [1], d=8.3-11 kpc [2], d=3.0 kpc (Σ-D), d=6 kpc adopted.

MS [2,3].

Remark: The SNR is weakly interacting with the molecular clouds [2].

[1] Green 2004; [2] Frail et al. 1996; [3] Reynoso and Mangum 2000.

G348.7+0.3 (CTB 37B, S, α=0.3, θ=17?, F=26, $\Sigma=1.35\times10^{-20}$)

d=10.2±3.5 kpc (21 cm HI line) [1], d=4.4 kpc (Σ-D), d=7 kpc adopted.

[1] Green 2004.

G349.2-0.1 (S, α=?, θ=9×6, F=1.4?, $\Sigma=3.90\times10^{-21}$)

d=16.8 kpc (Σ-D), d=16 kpc adopted.

G349.7+0.2 (S, α=0.5, θ=2.5×2, F=20, $\Sigma=6.02\times10^{-19}$)

d=18.3±4.6 kpc (21 cm HI line) [1], d>11.2 kpc (it may be d=22.4 kpc) [2], d=6.8 kpc (Σ-D), d=12 kpc adopted.

MC [2]; $L_X=1.8\times10^{37}$ erg/s (0.5-10 keV) at d=22 kpc [5]; t=2.8 kyr [5].

Remarks: In the Galaxy, 150 SNRs were examined to find interactions with maser sources, but only for 20 of them such interactions have been found. That present SNR is one of these 20. For the maser emission due to the interaction between the SNR and the molecular cloud to be produced, the cloud radiates at 50-125 K and the density of the H_2 molecules is 10^5 cm^{-3} [3].

There is a CO shell (with D=100 pc) around this SNR. Mass and density of the H_2 cloud are 9.3×10^5 $M_\odot$ and 35 cm^{-3} [3].

The SNR is within the HII region [3].

The magnetic field in the part of the SNR interacting with the cloud (OH maser region) is B$\sim$300 μG [4].

The remnant has an irregular shell morphology and is interacting with a molecular cloud, evident from the presence of OH (1720 MHz) masers and shocked molecular gas [5].

$N_{HI}\sim6.0\times10^{22}$ cm^{-2} is consistent with the large distance to the remnant of $\sim$22 kpc estimated from the maser velocities [5].

SNR G349.7+0.2 is the Galactic counterpart to N132D. It is an SNR with a small angular size (r$\sim$1 arcmin) and has the third highest radio surface brightness next to Cas A and Crab Nebula [5].

SNR N132D is in the Large Magellanic Cloud. It is a luminous ($\sim5\times10^{37}$ erg/s in X-ray band) small diameter SNR ($\theta\sim44''$ corresponding to 11.7 pc) that is evolving into a cavity wall on the edge of a molecular cloud [6,7].

Optical spectra [5,8] show that N132D is an Oxygen-rich SNR whose abundances are consistent with a $\sim$20 $M_\odot$ progenitor [5,9].

The maximum radio and X-ray brightness occurs in a region where the SNR shell is encountering a molecular cloud with a radius of 24$''$ (2.6 pc), a mass of 1.2×10^4 $M_\odot$, and a gas density of $\sim10^4$ cm^{-3} [3].

Molecular line observations toward the maser region in G349.7+0.2 confirm the presence of shocked molecular gas with density 10^5-10^6 cm^{-3} and temperature >40 K [10].

The strength of the line of sight magnetic field determined using Zeeman splitting of the OH (1720 MHz) line is $B=(3.5\pm0.5)\times10^{-4}$ G [4].

[1] Green 2004; [2] Frail et al. 1996; [3] Reynoso and Mangum 2001; [4] Brogan et al. 2000; [5] Slane et al. 2002; [6] Hughes 1987; [7] Banas et al. 1997; [8] Danziger and Dennefeld 1976; [9] Blair et al. 1994; [10] Lazendic et al. 2002.

G350.0-2.0 (S, α=0.4, θ=45, F=26, $\Sigma=1.93\times10^{-21}$)
d=3.1 kpc (Σ-D), d=3.1 kpc adopted.

G351.2+0.1 (C?, α=0.4, θ=7, F=5?, $\Sigma=1.54\times10^{-20}$)
d=10.1 kpc (Σ-D), d=10 kpc adopted.

G351.7+0.8 (S, α=?, θ=18×14, F=10?, $\Sigma=5.97\times10^{-21}$)
d=6.5 kpc (Σ-D), d=6.5 kpc adopted.

G351.9-0.9 (S, α=?, θ=12×9, F=1.8?, $\Sigma=2.51\times10^{-21}$)
d=12.8 kpc (Σ-D), d=12.8 kpc adopted.

G352.2-0.1
Remark: Radius of the SNR is 8 pc [1].

Point Source PSR J1726-3530
β=0.0 [1]; d=10 kpc [1]; P=1110 ms [1]; τ=14 kyr [1].

Remarks: The PSR is located right at the center of a previously uncatalogued shell having bilateral symmetry [1].

The morphology of the SNR and its relation to the PSR strongly suggest that it is an SNR associated with the PSR. Assuming it has the age and distance of the PSR, its expansion velocity is a very reasonable 1100 km/s [1].

[1] Manchester et al. 2002.

G352.7-0.1 (S, α=0.6, θ=8×6, F=4, $\Sigma=1.25\times10^{-20}$)
d=11.1 kpc (Σ-D), d=11 kpc adopted.

G353.9-2.0 (S, α=0.5?, θ=13, F=1?, $\Sigma=8.91\times10^{-22}$)
d=12.2 kpc (Σ-D), d=12 kpc adopted.

G354.1+0.1 (C?, α-varies?, θ=15×3?, F=?, Σ=?)

G354.8-0.8 (S, α=?, θ=19, F=2.8?, $\Sigma=1.17\times10^{-21}$)
d=8 kpc (Σ-D), d=8 kpc adopted.
Remark: G354.8-0.8 is a shell remnant [1] identified by [2].

Point Source PSR J1734-3333
β=2.2? [1]; d=7 kpc [1]; P=1169 ms [1]; τ=8.1 kyr [1] Remarks: The PSR and the SNR are possibly connected [1].

The PSR lies well outside the remnant, but the remnant is teardrop shaped and pointed directly toward the PSR with a bright spot at the point of the teardrop. Furthermore, there is weak evidence for a larger ring-shaped emission feature on the opposing side. It is possible that the SNR has a bi-annular morphology and is larger than previously thought [1].

[1] Manchester et al. 2002; [2] Whiteoak and Green 1996.

G355.6-0.0 (S, α=?, θ=8×6, F=3?, $\Sigma=9.41\times10^{-21}$)
d=12.5 kpc (Σ-D), d=12 kpc adopted.

G355.9-2.5 (S, α=0.5, θ=13, F=8, $\Sigma=7.12\times10^{-21}$)
d=7.4 kpc (Σ-D), d=7.4 kpc adopted.

G356.2+4.5 (S, α=0.7, θ=25, F=4, $\Sigma=9.63\times10^{-22}$)
d=6.3 kpc (Σ-D), d=6 kpc adopted.

G356.3-0.3 (S, α=?, θ=11×7, F=3?, $\Sigma=5.86\times10^{-21}$)
d=11.9 kpc (Σ-D), d=11.9 kpc adopted.

G356.3-1.5 (S, α=?, θ=20×15, F=3?, $\Sigma=1.51\times10^{-21}$)
d=8.4 kpc (Σ-D), d=8.4 kpc adopted.

G357.7-0.1 (MSH 17-39, ?, α=0.4, θ=8×3?, F=37, $\Sigma=2.32\times10^{-19}$)
d>6 kpc [1], d=11.8 kpc [2], d=4.8 kpc (Σ-D), d=7 kpc adopted.
MC [2]; kT$\sim$0.6 keV [3]; L_x(unabsorbed)$\sim9\times10^{35}$ erg/s (0.5-10 keV, for d=12 kpc) [3]; $N_{HI}\sim10^{23}$ cm^{-2} [3].

Remarks: Unusual Galactic radio source G357.7-0.1 (the "Tornado") [3].

No X-ray point source associated with the "Tornado" is seen down to a 3σ luminosity (0.5-10 keV) of 10^{33} erg/s for a distance of 12 kpc [3].

Within the SNR interpretation, the head of the "Tornado" is a limb-brightened radio shell containing centrally-filled thermal X-rays and which is interacting with a molecular cloud. Therefore, the "Tornado" is a mixed morphology SNR [3].

The maser velocity of -12 km/s implies a distance to the "Tornado" of 12 kpc [3], this distance has recently been confirmed by HI absorption [4].

[1] Radhakrishnan et al. 1972; [2] Frail et al. 1996; [3] Gaensler et al. 2003; [4] Brogan and Goss 2003.

G357.7+0.3 (S, α=0.4?, θ=24, F=10, $\Sigma=2.61\times10^{-21}$)
d=5.5 kpc (Σ-D), d=5.5 kpc adopted.
MS [1].
[1] Yusef-Zadeh et al. 1999.

G358.0+3.8 (S, α=?, θ=38, F=1.5?, $\Sigma=1.56\times10^{-22}$)
d=5.6 kpc (Σ-D), d=5.2 kpc adopted.

G359.0-0.9 (S, α=0.5, θ=23, F=23, $\Sigma=6.54\times10^{-21}$)
d=4.4 kpc (Σ-D), d=4.4 kpc adopted.

G359.1-0.5 (S, α=0.4?, θ=24, F=14, $\Sigma=3.66\times10^{-21}$)
d=5.2 kpc (Σ-D), d=5.2 kpc adopted.
MS [1].

Remarks: A complete nonthermal radio shell [2].

A strong local radio continuum source (G359.28-0.26) is located about 8$'$ from the edge of G359.1-0.5 with an apparent bow shock structure [2].

[1] Yusef-Zadeh et al. 1995; [2] Uchida et al. 1992.

G359.1+0.9 (S, α=?, θ=12×11, F=5?, $\Sigma=5.70\times10^{-21}$)
d=9.2 kpc (Σ-D), d=9.2 kpc adopted.

G359.23-0.82 (SNR candidate)
$d<5.5$ kpc (from HI absorption) [1]; $RA_{nebula}(2000)= 17^h47^m15^s.8$, $Dec_{nebula}(2000)=-29°58'00''$ [1].

Remarks: The "mouse" (G359.23-0.82 [2]) is among the few known non-thermal radio nebulae with axial symmetry consisting of a bright "head" and a long "tail" that is highly linearly polarized [1].

A nonthermal radio continuum feature with a cometary morphology [5].

Both G359.2-0.8 and G359.1-0.2 have been considered by some to be associated with the radio shell [5].

Unless G359.2-0.8 happens to coincidentally lie in a hole in the 3 kpc arm gas, it must be regarded as a foreground object lying between the Sun and the 3 kpc arm [5].

Point Source PSR J1747-2958
$d\sim2$ kpc [1]; $l=359°.305$, $b=-0°.841$ [1]; $RA_{PSR}(2000)=17^h47^m16^s.1$, $Dec_{PSR}(2000)=-29°58'07''$ [1]; $P=98.81275773$ ms [1]; $\dot{P}=6.136\times10^{-14}$ s/s [1]; $DM=101.5$ $cm^{-3}pc$ [1]; $\tau=25.5$ kyr [1]; $B=2.5\times10^{12}$ G [1]; $\dot{E}=2.5\times10^{36}$ erg/s [1]; $F_{1374}=0.25\pm0.03$ mJy [1], F_x(unabsorbed)$\cong3\times10^{-11}$ erg/cm^{2}s (2-10 keV) [4]; $L_{1400}\sim1$ mJy kpc^2 (for d=2 kpc) [1]; $L_x\sim1.4\times10^{34}d_2^2$ erg/s [1].

Remarks: The PSR (timing) position is consistent with that of the "Mouse"s (G359.23-0.82) "head" [1].

PSR J1747-2958, moving at supersonic speed through the local interstellar medium, powers this unusual non-thermal nebula [1].

No central engine had been detected in previous radio pulsation searches [1].

The "head" of the "Mouse" was detected in X-rays, although with limited statistics [3] and angular resolution [4].

[1] Camilo et al. 2002b; [2] Yusef-Zadeh and Bally 1987; [3] Predehl and Kulkarni 1995; [4] Sidoli et al. 1999; [5] Uchida et al. 1992.

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ПОСМАТРАЧКИ ПОДАЦИ О ГАЛАКТИЧКИМ ОСТАЦИМА ЕКСПЛОЗИЈА СУПЕРНОВИХ ЗВЕЗДА: II. ОСТАЦИ СУПЕРНОВИХ ЗА $l = 270° - 360°$

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Стручни рад

Сакупили смо све расположиве податке из литературе о Галактичким остацима експлозија супернових звезда. У овом раду смо представили податке из свих спектралних опсега, о остацима супернова који се налазе у интервалу Галактичке лонгитуде од 270° до 360°. Установили смо вредности растојања до остатака супернова испитујући одговарајуће даљине. Подаци за различите типове неутронских звезда повезаних са остацима супернова су такође приказани. Осим што су приказани подаци, дати су и коментари других аутора, као и наши сопствени, а у вези података и неких особина остатака супернова и тачкастих извора.