

**A Catalogue of  
Galactic Supernova Remnants  
(2022 December version)**

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## 1. The Catalogue Format

This catalogue of Galactic supernova remnants (SNRs) is an updated version of those presented in detail in Green (1984, 1988) and in summary form in Green (1991, 1996, 2004, 2009, 2014, 2019) – hereafter Versions I, II, III, IV, V, VI, VII and VIII respectively – and on the Web, in versions of 1995 July, 1996 August, 1998 September, 2000 August, 2001 December, 2004 January, 2006 April, 2009 March and 2017 June. (Version IV, although published in 1996, was produced in 1993, and a detailed version of this was made available on the Web in 1993 November). The summary data from the 2001 December version of the catalogue was also published as an Appendix in Stephenson & Green (2002).

This, the 2022 December version of the catalogue contains 303 SNRs (which is nine more than in the previous version; fourteen remnants have been added, and five objects removed), with over three thousand references in the detailed listings, plus notes on many possible or probable remnants. For each remnant in the catalogue the following parameters are given.

- **Galactic Coordinates** of the remnant. These are quoted to a tenth of a degree, as is conventional. In this catalogue additional leading zeros are not used. These are generally taken from the Galactic coordinate based name used for the remnant in the literature. It should be noted that when these names were first defined, they may not follow the IAU recommendation (see: <http://cdsweb.u-strasbg.fr/Dic/iau-spec.htx>) that coordinates should be truncated, not rounded to construct such names.
- **Other Names** that are commonly used for the remnant. Note that these are given in parentheses if the remnant is only a part of the source. For some well known remnants – e.g. G184.6–5.8 (=Crab nebula) – not all common names are given.
- **Right Ascension** and **Declination** of J2000.0 equatorial coordinates the source centroid, which an accuracy of the quoted values depends on the size of the remnant. For small remnants they are to the nearest few seconds of time and the nearest minute of arc respectively, whereas for larger remnants they are rounded to coarser values, but are in every case sufficient to specify a point within the boundary of the remnant. These coordinates are usually deduced from radio images rather than from X-ray or optical observations.

- **Angular Size** of the remnant, in arcminutes. This is usually taken from the highest resolution radio image available. The boundary of most remnants approximates reasonably well to a either circle or to an ellipse. A single value is quoted for the angular size of the more nearly circular remnants, which is the diameter of a circle with an area equal to that of the remnant. For more elongated remnants the product of two values is given, which are the major and minor diameters of the remnant boundary modelled as an ellipse. In a small number of cases an ellipse is not a good description of the boundary of the object (which will be noted in the description of the object given in its catalogue entry), although an angular size is still quoted for information. For ‘filled-centre’ type remnants (see below), the size quoted is for the largest extent of the observed emission, not, as at times has been used by others, the half-width of the centrally brightened peak.
- **Flux Density** of the remnant at a frequency of 1 GHz, in jansky. This is *not* a measured value, but is instead derived from the observed radio spectrum of the source. The frequency of 1 GHz is chosen because flux density measurements are usually available at both higher and lower frequencies. Some young remnants – notably G111.7–2.1 (=Cassiopeia A) and G184.6–5.8 (=Crab Nebula), but also G130.7+3.1 (=3C58) and G120.1+1.4 (=Tycho) – show secular variations in their radio flux density. In this version of the catalogue the 1-GHz flux densities for G111.7–2.1 and G184.6–5.8 have been taken from Perley & Butler (2017), for an epoch of 2016. Results from the primary literature should be used for any detailed quantitative studies of the radio spectra these and other remnants.
- **Spectral Index** of the integrated radio emission from the remnant,  $\alpha$  (here defined in the sense,  $S \propto \nu^{-\alpha}$ , where  $S$  is the flux density at a frequency  $\nu$ ), either a value that is quoted in the literature, or one deduced from the available integrated flux densities of the remnant. For several SNRs a simple power law is not adequate to describe their radio spectra, either because there is evidence that the integrated spectrum is curved or the spectral index varies across the face of the remnant. In these cases the spectral index is given as ‘varies’ (refer to the description of the remnant and appropriate references in the detailed catalogue entry for more information). In some cases, for example where the remnant is highly confused with thermal emission, the spectral index is given as ‘?’ since no value can be deduced with any confidence.
- **Type** of the SNR: ‘S’ or ‘F’ if the remnant shows a ‘shell’ or ‘filled-centre’ structure, or ‘C’ if it shows ‘composite’ (or ‘combination’) radio structure, with a combination of shell and filled-centre characteristics. If there is some uncertainty, the type is given as ‘S?’, ‘F?’ or ‘C?’, and as ‘?’ in several cases where an object is conventionally regarded as an SNR even though its nature is poorly known or it is not well-understood. Until recently only a few remnants were classified as composite remnants, as available observations were only able to identify the more obvious pulsar-powered, flatter radio spectrum filled-centre components within shells. However, in recent years improved observations – particularly in X-rays with the Chandra satellite – have identified many faint, pulsar powered nebulae in what until then had been identified as pure shell remnants. (Note: the term ‘composite’ has been used, by some authors, in a different sense, to describe remnants with radio shell and centrally-brightened X-ray emission. An alternative term used to describe such remnants is ‘mixed morphology’, see Rho & Petre 1998.)

In the detailed listings, for each remnant, notes on a variety of topics are given. First, it is noted if other Galactic coordinates have at times been used to label it (usually before good observations have revealed the full extent of the object), if the SNR is thought to be the remnant of a historical SN, or if the nature of the source as an SNR has been questioned (in which case an appropriate reference is usually given later in the entry). Brief descriptions of the remnant from the available radio, optical and X-ray observations as applicable are then given, together with notes on available distance determinations, and any point sources or pulsars in or near the object (although they may not necessarily be related to the remnant). Finally, appropriate published references to observations are given for each remnant, complete with journal, volume, page, and a short description of what information each paper contains (for radio observations these include the telescopes used, the observing frequencies and resolutions, together with any flux density determinations). These references are *not* complete, but cover representative and recent observations of the remnant – up to the end of 2021 in this version of the catalogue – and they should themselves include references to earlier work.

The references do not generally include large observational surveys – of particular interest in this respect are: the Effelsberg 100-m survey at 2.7 GHz of the Galactic plane  $358^\circ \leq l \leq 240^\circ$ ,  $|b| \leq 5^\circ$  by Reich *et al.* (1990) and Fürst *et al.* (1990a); reviews of the radio spectra of some SNRs by Kassim (1989), Kovalenko, Pynzar’ & Udal’tsov (1994) and Trushkin (1998); the Parkes 64-m survey at 2.4 GHz of the Galactic plane  $238^\circ < l < 365^\circ$ ,  $|b| < 5^\circ$  by Duncan *et al.* (1995) and Duncan *et al.* (1997); the Molonglo Galactic plane survey at 843 MHz of  $245^\circ < l < 355^\circ$ ,  $|b| < 1.5^\circ$  by Green *et al.* (1999); the survey of  $345^\circ < l < 255^\circ$ ,  $|b| < 5^\circ$  at 8.35 and 14.35 GHz by Langston *et al.* (2000); Multi-Array Galactic Plane Imaging Survey (MAGPIS), see White, Becker & Helfand (2005) and Helfand *et al.* (2006); the VLA Galactic Plane Survey, see Stil *et al.* (2006); the GLOSTAR Galactic radio survey of the region  $358^\circ \leq l \leq 60^\circ$ ,  $|b| \leq 1^\circ$ , see Dokara *et al.* (2021); the survey of H I emission towards SNRs by Koo & Heiles (1991); surveys of IRAS observations of SNRs and their immediate surroundings by Arendt (1989) and by Saken, Fesen & Shull (1992); various Spitzer surveys of inner galaxy (Reach *et al.* 2006; Carey *et al.* 2009; Pinheiro Gonçalves *et al.* 2011); the catalogue by Fesen & Hurford (1996) of UV/optical/infra-red lines identified in SNRs; references to the first Fermi SNR catalogue (Acero *et al.* 2016) are included for the 30 ‘Classified Candidates’ and 14 ‘Marginally Classified Candidates’ remnants listed in Table 1, but not for the other remnants with non-detection; the H.E.S.S. high energy  $\gamma$ -ray Galactic plane survey (H.E.S.S. Collaboration: Abdalla *et al.* 2018a) and the 4th Fermi LAT Catalogue (Abdollahi *et al.* 2020). Also see Ferrand & Safi-Harb (2012), present a census of X-/ $\gamma$ -ray observations of Galactic SNRs and pulsar wind nebulae (PWNe), updates of which are available at <http://snrcat.physics.umanitoba.ca/>.

A summary of the data available for all 303 remnants in the catalogue is given in Table I. The other names for SNRs are listed in Table II, and the abbreviations for journals, proceedings and telescopes are listed in Table III. The detailed listings for each SNR are given in Table IV.

## 2. Revisions and Notes

### 2.1 Objects no longer thought to be SNRs

The following objects, which were listed in Version I of the catalogue were removed because they were no longer thought to be remnants, or were poorly observed (see Version II for references and further details): G2.4+1.4 (see also Gray 1994a; Goss & Lozinskaya 1995; Polcaro *et al.* 1995, Prajapati *et al.* 2019), G41.9–4.1 (=CTB 73, PKS 1920+06), G47.6+6.1 (=CTB 63), G53.9+0.3 (part of HC40), G93.4+1.8 (=NRAO 655), G123.2+2.9, G194.7+0.4 (the Origem Loop, but see below for more recent work), G287.8–0.5 (see below), G322.3–1.2 (=Kes 24) and G343.0–6.0 (but note that G343.0–6.0 was subsequently reinstated into the catalogue, due to improved observations, see below). Note that subsequently Leahy, Tian & Wang (2008) again proposed that a large (about  $0.5^\circ$ ) radio shell, G53.9+0.2, as a possible old SNR. As noted above, this feature was included, as G53.9+0.3 (part of HC40), in Version I of the catalogue, but was subsequently removed, following the discussions of Caswell (1985) who concluded it was a thermal source (see also Velusamy, Goss & Arnal 1986; Zychová & Ehlerová 2016; Driessen *et al.* 2018). G358.4–1.9, which was listed in Version IV of the catalogue, was removed, as following the discussion of Gray (1994a), as it is not clear that this is a SNR. G240.9–0.9, G299.0+0.2 and G328.0+0.3, which were listed in 1995 July version of the catalogue, were removed from the 1996 August version, following the improved observations of Duncan *et al.* (1996) and Whiteoak & Green (1996). For the 1998 September revision of the catalogue G350.0–1.8 was incorporated into G350.0–2.0, and G337.0–0.1 refers to a smaller remnant than that previously catalogued with the same name. G112.0+1.2, G117.4+5.0, G152.2–1.2 and G211.7–1.1 – which were reported as SNRs by Bonsignori-Facondi & Tomasi (1979) – were removed from the 2001 December version of the catalogue, as the first three of these are not confirmed as SNRs from the Canadian Galactic Plane Survey (Roland Kothés, private communication). G10.0–0.3, which was regarded as a remnant – possibly associated with a soft-gamma repeater – was removed from the 2004 January version of the catalogue, as it is now thought to be radio nebula powered by a stellar wind (see Gaensler *et al.* 2001, Corbel & Eikenberry 2004, and references therein). G166.2+2.5 (=OA 184) was removed from the 2006 April version of the catalogue, as it was identified as an H II region by Foster *et al.* (2006). G84.9+0.5 was removed from Version VI of the catalogue, as it was identified as an H II region by Foster *et al.* (2007; see also Kothés *et al.* 2006). G16.8–1.1 was removed from Version VII of the catalogue (Sun *et al.* 2011; Stupar & Parker 2011). G192.8–1.1 was removed from the 2017 June version of the catalogue, as Gao *et al.* (2011) had shown this is not a SNR (Kang, Koo & Byun 2014). It was erroneously not removed in Version VII of the catalogue. Five entries (G20.4+0.1, G21.5–0.1, G23.6+0.3, G59.8+1.2 and G65.8–0.5) were removed from Version VIII of the catalogue, as Anderson *et al.* (2017), based on THOR and VGPS radio and IR survey observations, concluded they are not SNRs, but have been confused with H II regions. Anderson *et al.* also identified one other entry, G54.1+0.3 as not being a SNR. This used to be in the catalogue as a filled-centre remnant, as it shows a centrally brightened morphology in radio and X-ray observations, and contains a pulsar. It was reclassified as somewhat larger possible composite remnant when a larger, faint X-ray emission was identified, from which radio emission, with polarised loops was subsequently found. Thus G54.1+0.3 was retained in the catalogue as a composite remnant because of its X-ray and polarised radio emission, although it may be an isolated PWN.

In this version of the catalogue five entries have been removed. G11.1–1.0 and G16.4–0.5, which Gao *et al.* (2019) identified as HII regions rather than SNRs. (Gao *et al.* also identified G20.4+0.1 as an HII region, which had been removed from Version III of the catalogue.) G8.3–0.0, G10.5–0.0 and G14.3+0.1, which Dokara *et al.* (2021) identified as HII regions rather than SNRs. (Dokara *et al.* also identified G11.1–1.0 as an HII region.)

The following objects, which have been reported as SNRs, but have not been included in any of the versions of the SNR catalogue, have subsequently been shown not to be SNRs.

- G70.7+1.2, which was reported as a SNR by Reich *et al.* (1985), but this has not been confirmed by later observations (see Green 1986; de Muizon *et al.* 1988; Becker & Fesen 1988; Bally *et al.* 1989; Phillips, Onello & Kulkarni 1993; Onello *et al.* 1995; Cameron & Kulkarni 2007).
- G81.6+1.0 a possible SNR in W75 reported by Ward-Thompson & Robson (1991). From the published data (see the observations in Wendker, Higgs & Landecker 1991) it was noted in Version IV of the catalogue that this is thermal source not a SNR, because of its thermal radio spectrum, and high infrared-to-radio emission (see also the subsequent discussion by Wendker *et al.* 1993).
- Green & Gull (1984) suggested G227.1+1.0 as a very young SNR, but subsequent observations (Channan *et al.* 1986; Green & Gull 1986) have shown that this is most likely an extragalactic source, not an SNR.
- A candidate SNR, G274.7–2.8, identified by Helfand & Channan (1989), has been shown not to be a SNR by Caswell & Stewart (1991).
- G159.6–18.5, was suggested as a SN by Pauls & Schwartz (1989), from IRAS and other observations – see also Fiedler *et al.* (1994) – but appears to be an HII region (see Andersson *et al.* 2000, Ridge *et al.* 2006, Remy *et al.* 2018, Millard *et al.* 2021).
- G25.5+0.2, which was reported as a very young SNR by Cowan *et al.* (1989), although this identification was not certain (see White & Becker 1990; Green 1990a; Zijlstra 1991). Sramek *et al.* (1992) report the detection of recombination lines from this source (also see Subrahmanyan *et al.* 1993). Becklin *et al.* (1994) identify G25.5+0.2 as a ring nebula around a luminous blue star. See also Clark, Steele & Langer (2000), and Phillips & Ramos-Larios (2008) who identified G25.5+0.2 as a possible symbiotic outflow.
- Several of the possible SNRs listed by Gorham (1990) – following up SNR candidates suggested by Kassim (1988a) – have been shown likely not to be SNRs by Gorham, Kulkarni & Prince (1993).
- A possible SNR (G32.1+0.1) reported from optical spectroscopy by Thompson, Djorgovski & de Carvalho (1991), following up radio and infrared observations of Jones, Garwood & Dickey (1988), although this has a thermal radio spectrum, and has been identified as an ultra-compact HII region (e.g. Watson *et al.* 2003, Leto *et al.* 2009).
- G203.2–12.3, a optical ring about 3 arcmin in diameter, was reported as a possible SNR by Winkler & Reipurth (1992), but was shown to be a Herbig–Haro object (HH 311) by Reipurth, Bally & Devine (1997), see also Rosado, Raga & Arias (1999).
- G104.7+2.8, a possible SNR suggested by Green & Joncas (1994), which instead appears to be an HII region, based on the improved observations by Kerton (2006) and Kothes *et al.* (2006).
- G247.8+4.9 was noted as a possible optical SN by Weinberger (1995), see also Zanin & Kerber (2000). However, it is regarded as a possible or probably planetary nebula (PN) by both Parker *et al.* (2006) and Frew, Bojičić & Parker (2013).
- G359.87+0.18 was reported as a possible young SNR near the Galactic Centre by Yusef-Zadeh, Cotton & Reynolds (1998), but was shown to be a radio galaxy by Lazio *et al.* (1999).
- Morris *et al.* (2006) suggested small remnant observed by Spitzer, which has subsequently instead been identified as a likely PN by Fesen & Milisavljevic (2010), see also Mizuno *et al.* (2010).
- Sawada *et al.* (2009) identified G1.2–0.0 as a SNR, which has been identified as an HII region by Hurley-Walker *et al.* (2019a).
- An extended region of X-ray emission, near  $l = 356^\circ 8$ ,  $b = -1^\circ 7$  is reported as a possible SNR by Tomsick *et al.* (2009). Subsequently Barrière *et al.* (2015) identified this as a galaxy cluster and blazar.
- The TeV  $\gamma$ -ray source MGRO J2019+37 is discussed by Saha & Bhattacharjee (2014) as either a PWN or SNR. (Note that declination for the source given by Saha & Bhattacharjee is wrong.) However, the SNR identification is not supported by observations by Aliu *et al.* (2014), who resolve MGRO J2019+37 into two sources, one associated with G74.9+1.2, and the other with the pulsar J2021+3651.
- G354.4+0.0 a possible small remnant reported by Roy & Pal (2013) from radio observations, which has been identified as an HII region by Hurley-Walker *et al.* (2019a).

Also see further comments in Section 2.3, when there is evidence that some other objects which have been proposed SNRs are not remnants.

Some entries in the catalogue have been renamed, due to improved observations revealing a larger true extent for the object (previously G5.3–1.0 is now G5.4–1.2; G308.7+0.0 is now incorporated into G308.8–0.1). G337.0–0.1 now refers to a small (1.5 arcmin) remnant, rather than larger supposed remnant at this position (see Sarma *et al.* 1997), and G350.0–2.0 now incorporates the previously catalogued G350.0–1.8, based on the improved observations of Gaensler (1998). G106.6+2.9, which was proposed as a small remnant by Halpern *et al.* (2001), is incorporated into the larger catalogued remnant G106.3+2.7.

## 2.2 New SNRs

The following remnants were added to Version II of the catalogue: G0.9+0.1, G1.9+0.3, G5.9+3.1, G6.4+4.0, G8.7–0.1, G18.9–1.1, G20.0–0.2, G27.8+0.6, G30.7+1.0, G31.5–0.6, G36.6–0.7, G42.8+0.6, G45.7–0.4, G54.1+0.3, G73.9+0.9, G179.0+2.6, G312.4–0.4, G357.7+0.3 and G359.1–0.5.

The following remnants were added to Version III of the catalogue: G4.2–3.5, G5.2–2.6, G6.1+1.2, G8.7–5.0, G13.5+0.2, G15.1–1.6, G16.7+0.1, G17.4–2.3, G17.8–2.6, G30.7–2.0, G36.6+2.6, G43.9+1.6, G59.8+1.2, G65.1+0.6, G68.6–1.2, G69.7+1.0, G279.0+1.1, G284.3–1.8 (=MSH 10–53), G358.4–1.9 and G359.0–0.9 (although, as noted above, G59.8+1.2 and G358.4–1.9 have subsequently been removed).

The following remnants were added to Version IV of the catalogue: G59.5+0.1, G67.7+1.8, G84.9+0.5, G156.2+5.7, G318.9+0.4, G322.5–0.1, G343.1–2.3 and G348.5–0.0 (although, as noted above, G84.9+0.5 was subsequently removed).

The following remnants were added to 1995 July version of the catalogue: G1.0–0.1, G1.4–0.1, G3.7–0.2, G3.8+0.3, G28.8+1.5, G76.9+1.0, G272.2–3.2, G341.2+0.9, G354.1+0.1, G355.6–0.0, G356.3–0.3, G356.3–1.5 and G359.1+0.9.

The following remnants were added to the 1996 August version of the catalogue: G13.3–1.3, G286.5–1.2, G289.7–0.3, G294.1–0.0, G299.2–2.9, G299.6–0.5, G301.4–1.0, G308.1–0.7, G310.6–0.3, G310.8–0.4, G315.9–0.0, G317.3–0.2, G318.2+0.1, G320.6–1.6, G321.9–1.1, G327.4+1.0, G329.7+0.4, G342.1+0.9, G343.1–0.7, G345.7–0.2, G349.2–0.1, G351.7+0.8, G351.9–0.9 and G354.8–0.8.

The following remnants were added to the 1998 September version of the catalogue: G0.3+0.0, G32.1–0.9, G55.0+0.3, G63.7+1.1 and G182.4+4.3.

The following remnants were added to the 2000 August version of the catalogue: G7.0–0.1, G16.2–2.7, G29.6+0.1, G266.2–1.2 and G347.3–0.5.

The following remnants were added to the 2001 December version of the catalogue: G4.8+6.2, G28.6–0.1, G85.4+0.7, G85.9–0.6, G106.3+2.7, G292.2–0.5, G343.0–6.0, G353.9–2.0, G356.2+4.5 and G358.0+3.8.

G312.5–3.0 was added to Version V of the catalogue.

The following remnants were added to the 2006 April version of the catalogue: G5.5+0.3, G6.1+0.5, G6.5–0.4, G7.2+0.2, G8.3–0.0, G8.9+0.4, G9.7–0.0, G9.9–0.8, G10.5–0.0, G11.0–0.0, G11.1–0.7, G11.1–1.0, G11.1+0.1, G11.8–0.2, G12.2+0.3, G12.5+0.2, G12.7–0.0, G12.8–0.0, G14.1–0.1, G14.3+0.1, G15.4+0.1, G16.0–0.5, G16.4–0.5, G17.0–0.0, G17.4–0.1, G18.1–0.1, G18.6–0.2, G19.1+0.2, G20.4+0.1, G21.0–0.4, G21.5–0.1, G32.4+0.1, G96.0+2.0, G113.0+0.2 and G337.2+0.1 (as noted above, G8.3–0.0, G10.5–0.0, G11.1–1.0, G14.3+0.1, G16.4–0.5, G20.4+0.1 and G21.5–0.1 have subsequently been removed).

The following remnants were added to Version VI of the catalogue: G83.0–0.3, G108.2–0.6, G315.1+2.7, G332.5–5.6, G327.2–0.1, G350.1–0.3, G353.6–0.7, G355.4+0.7, G358.1+1.0 and G358.5–0.9. Note that G358.1+1.0 was in Versions VI and VII with the wrong name, G358.1+0.1, which has been corrected in this revision.

The following remnants were added to Version VII of the catalogue: G21.6–0.8, G25.1–2.3, G35.6–0.4, G38.7–1.3, G41.5+0.4, G42.0–0.1, G64.5+0.9, G65.8–0.5, G66.0–0.0, G67.6+0.9, G67.8+0.5, G152.4–2.1, G159.6+7.3, G178.2–4.2, G190.9–2.2, G213.0–0.6, G296.7–0.9, G306.3–0.9, G308.4–1.4, G310.6–1.6 and G322.1+0.0 (as noted above, G65.8–0.5 has subsequently been removed).

G70.0–21.5 and G351.0–5.4 were added to the 2017 June version of the catalogue.

The following remnants were added to Version VIII of the catalogue: G181.1+9.5, G323.7–1.0, G150.3+4.5 and G53.4+0.0.

The following remnants have been added to this version of the catalogue.

- Hurley-Walker *et al.* (2019a) identify several new SNRs which had previously been suggested as candidate remnants by Gorham (1990) Gray (1994b), Duncan *et al.* (1995, 1997), Whiteoak & Green (1996), Brogan *et al.* (2006) and Roberts & Brogan (2008), namely: G3.1–0.6, G7.5–1.7, G13.1–0.5, G15.5–0.1, G28.3+0.2, G28.7–0.4, G345.1–0.2, G345.1+0.2, G348.8+1.1, G353.3–1.1 and G359.2–1.1. (Another of the SNRs identified by Hurley-Walker *et al.* has been included in the catalogue, as G9.7–0.0, since 2006.)
- G21.8–3.0 identified from radio and observations by Gao *et al.* (2020).
- G107.0+9.0, a large ring of optical filaments noted by Fesen *et al.* (2020), which was subsequently studied at radio wavelengths by Reich, Gao & Reich (2021).
- G249.5+24.5, a large ( $\sim 4$  degree) shell remnant found by Becker *et al.* (2021) from eROSITA X-ray and other observations.

### 2.3 Possible and probable SNRs not listed in the catalogue

The following are possible or probable SNRs for which further observations are required to confirm their nature or parameters.

#### 2.3.1 Radio

- Gómez-González & del Romero (1983) report a possible SNR G57.1+1.7 (about 40 arcmin in extent), near the pulsar PSR 1930+22. Later Routledge & Vaneldik (1988) instead proposed a possible larger remnant, nearly  $2^\circ$  in diameter, near the same pulsar. See also Kovalenko (1989).
- A possible SNR near the Galactic centre reported by Ho *et al.* (1985) from radio observations (see also Coil & Ho 2000; Lu, Wang & Lang 2003; Senda, Murakami & Koyama 2003, Johnson, Dong & Wang 2009). More recently Zhang *et al.* (2014) do not support a SNR identification for this source.
- Gosachinskiĭ (1985) reported evidence for non-thermal radio emission, presumably from SNRs, associated with several bright, thermal Galactic sources. Some of these sources have been included in the catalogue, following improved observations. See also Odegard (1986), who questions the reliability of some of Gosachinskiĭ’s results, and also suggest another possible SNR, G7.6–0.6, and Hurley-Walker *et al.* (2019a) who identify two of Gosachinskiĭ’s sources as HII regions.
- G300.1+9.4, a possible SNR nearly  $2^\circ$  in diameter reported by Dubner, Colomb & Giacani (1986).
- Gorham (1990) lists many SNR candidates from the Clark Lake 30.9 MHz survey of the first quadrant, following Kassim (1988a), one of which (G13.1–0.5) is included in the catalogue following improved observations by Hurley-Walker *et al.* (2019a). Several other have been shown not to be SNRs by Gorham, Kulkarni & Prince (1993). Gorham *et al.* report a poorly defined possible remnant G41.4+1.2 (previously G41.6+1.2 in Gorham 1990). Aharonian *et al.* (2008a) note that one of Gorham’s candidates, G44.6+0.1, is in the vicinity of an extended region of  $\gamma$ -ray emission HESS J1912+101 (see also Su *et al.* 2018, H.E.S.S. Collaboration: Abdalla *et al.* 2018b). There are in fact two candidate remnants in Gorham (1990) which overlaps HESS J1912+101, namely G44.6+0.1 and also G44.2+0.5 (although it should be noted that Gorham’s absolute positions are uncertain due to ionospheric effects, see Kassim 1988b). Plus, there is another candidate SNR overlapping HESS J1912+101, G44.0–0.1 from Trushkin (2001), see below. Another  $\gamma$ -ray source, HESS J1857+026 (see Ackermann *et al.* 2017) corresponds to Gorham’s candidate remnant G36.0–0.2.
- Four possible remnants (G45.9–0.1, G71.6–0.5, G72.2–0.3 and G85.2–1.2) of the eleven reported by Taylor, Wallace & Goss (1992) from a radio survey of part of the Galactic plane (see also Kothes *et al.* 2006). Six of the other possible SNRs reported by Taylor *et al.*, are included in the catalogue as G55.0+0.3, G59.5+0.1, G63.7+1.1, G67.7+1.8, G76.9+1.0 and G83.0–0.3, following improved observations which have confirmed their nature. The other candidate, G84.9+0.5, was included in earlier versions of the catalogue, but was removed in Version VI, as it has been shown to be an HII region (see above).
- Gray (1994b) identify several possible SNRs from radio observations near the Galactic centre, some of which have been included in the catalogue, following additional observations. See also Roy & Pramesh Rao (2002) and Bhatnagar (2002) for additional observations.
- Duncan *et al.* (1995) and Duncan *et al.* (1997) list several large-scale (1.5 to 10 degree), and smaller, low radio surface-brightness candidate SNRs from the Parkes 2.4-GHz survey of  $270^\circ < l < 360^\circ$ . Several of these candidates have been confirmed as SNRs by subsequent, improved observations, and are included in the catalogue. See also: Walker & Zealey (1998) for details of an optical shell around the Coalsack Nebula (near  $l = 300^\circ$ ,  $b = 0^\circ$ ) which overlaps one of these candidates; Camilo *et al.* (2004), Chang *et al.* (2012) and Danilenko *et al.* (2012) for further observations of another, G309.8–2.6, which is near a young pulsar; Russeil *et al.* (2005), who detected optical filaments from a third; and Shan *et al.* (2019).
- Whiteoak & Green (1996), from their radio survey of much of the southern Galactic plane, list many possible SNRs, several of which have been included in the catalogue, following improved observations, while most have not. See also Green, Reeves & Murphy (2014) and Ingallinera *et al.* (2019) for additional radio observations of some of these. Another of the possible SNRs listed in Whiteoak & Green (1996), G319.9–0.7, has been identified as a pulsar bow-shock by Ng *et al.* (2010).
- Combi & Romero (1998), Combi, Romero & Arnal (1998), Combi, Romero & Benaglia (1998), Punsly *et al.* (2000) and Combi *et al.* (2001) report several candidate SNRs from spatially filter radio survey images.

- Possible SNRs, near  $l = 313^\circ$ , were reported by Roberts *et al.* (1999), and Roberts, Romani & Johnston (2001). See also Aharonian *et al.* (2006)  $\gamma$ -ray observations of the region.
- G359.07–0.02, a possible SNR noted by LaRosa *et al.* (2000), see also Nakashima *et al.* (2010) and Ponti *et al.* (2015).
- A possible SNRs near G6.4–0.1 (=W28) noted by Yusef-Zadeh *et al.* (2000). (A second possible remnant noted by Yusef-Zadeh *et al.* has been included in the catalogue, as G6.5–0.4, following the improved observations of it by Brogan *et al.* 2006).
- Gaensler *et al.* (2000), in a search for pulsar wind nebulae, found a small shell of radio emission near PSR B1356–60 – which they designate G311.28+1.09 – which may be a supernova remnant.
- A possible SNR, G328.6–0.0, noted by McClure-Griffiths *et al.* (2001) in the test region of the Southern Galactic Plane Survey.
- G346.5–0.1, an arc of radio emission observed by Gaensler *et al.* (2001), which is potentially part of a SNR, but requires further observations to confirm its nature.
- Giacani *et al.* (2001) presented observations of a pulsar wind nebula around PSR J1709–4428, which may be part of the catalogued remnant G343.1–2.3, or may represent another object.
- Several possible SNRs reported by Trushkin (2001), which were identified from Galactic radio surveys (one of which, G6.1+0.5, is included in the catalogue, due to improved subsequent observations). One of these, G5.3+0.1 has been identified as an HII region by Hurley-Walker *et al.* (2019a). See also Reich & Sun (2019) and Zhang *et al.* (2020b).
- Two possible SNRs (G336.1–0.2 and G352.2–0.1) discussed briefly by Manchester *et al.* (2002).
- G282.8–1.2, a possible young SNR noted by Misanovic, Cram & Green (2002).
- G43.5+0.6, one of three possible SNRs identified by Kaplan *et al.* (2002); the other two are included in the catalogue, as G41.5+0.4 and G42.0–0.1, because subsequent observations have shown they have non-thermal radio spectra.
- Two candidate large SNRs (diameters of approximately  $3^\circ$  and  $1^\circ 6'$ ) are reported from radio surveys in the Galactic anticentre by Reich (2002), although their coordinates are not given. See also Soberski, Reich & Wielebinski (2005).
- G107.5–1.5, a probable remnant identified at by Kothes (2003), but the full extent of which is not well defined at present (see also Kothes *et al.* 2006; Jackson, Safi-Harb & Kothes 2014).
- Zhang (2003) identified four candidate SNRs from radio surveys, on the basis of shell structure with apparent non-thermal radio spectra. One of these – called G41.9+0.04 by Zhang – corresponds to the catalogued SNR G42.0–0.1. However, the other three proposed SNR candidates appear to be thermal sources, not SNRs. First, the source called G47.8+2.03 by Zhang has a thermal spectrum on the basis of its published 2.7-GHz flux density (Fürst *et al.* 1990b) and Zhang’s 1.4-GHz flux density. Second, Zhang’s source G74.8+0.63 is a known HII region Sharpless Sh 2-104 (e.g. Dickel & Milne 1972; Israël 1977; Weiler & Shaver 1978; Pineault & Chastenay 1990). Note that Israël had discussed that this source had been included in some SNR earlier catalogues (Milne 1970; Downes 1971), before the HII region identification became clear. Third, Zhang’s source G93.2+2.63, is identified as a thermal source by Arvidsson, Kerton & Foster (2009), as radio recombination lines from it have been detected.
- Brogan *et al.* (2006) identified 35 new SNRs in the region  $4^\circ 5' < l < 22^\circ$ ,  $|b| < 1^\circ 25'$ , of which the 31 which are classed as ‘I’ or ‘II’ (i.e. those thought to be very or fairly confidently identified as SNRs) were included in the 2006 version of the catalogue. Several of these – G8.3–0.0, G10.5–0.0, G11.1–1.0, G14.3+0.1, G16.4–0.5, G20.4+0.1 and G21.5–0.1 – have subsequently been removed, as they have been identified as HII regions (see above). Brogan *et al.* also listed four other possible SNRs which required further observations to confirm their nature and better define their parameters, one of which (G15.5–0.1) has been included in this version of the catalogue, following observations by Hurley-Walker *et al.* (2019a). See also Aharonian *et al.* (2008b), Hewitt & Yusef-Zadeh (2009), Joubert *et al.* (2016), Stupar, Parker & Few (2018) and Shan *et al.* (2018).

- Helfand *et al.* (2006) list many SNR candidates in the region  $5^\circ < l < 32^\circ$ ,  $|b| < 0.8^\circ$  from MAGPIS. Many of these correspond to sources in Brogan *et al.*, and several are included in the catalogue, with the others requiring further observations. Note that the integrated flux densities reported in Helfand *et al.* are very high compared with those reported in Brogan *et al.*. One of these candidates, G29.07+0.45, is known planetary nebula (Abell 1955, 1966; see also Todt *et al.* 2013, Frew *et al.* 2014). Many of these candidate SNRs are also discussed by Johanson & Kerton (2009), who conclude that eight of them are HII regions rather than SNRs. Several of these candidates are also associated with ‘bubbles’ from HII regions (Simpson *et al.* 2012), or with known or candidate HII region in the WISE HII region catalogue (Anderson *et al.* 2014, Hurley-Walker *et al.* 2019a). Much of region covered by the MAGPIS survey has more recently been observed by the THOR and GLOSTAR surveys, see further discussion below (and also Goss, Matthews & Winnberg 1978; Subrahmanyan & Goss 1996; Kargaltsev & Pavlov 2007; Lee *et al.* 2012).
- Martí *et al.* (2007), report extended radio emission near the X-ray source KS 1741–295 near the Galactic centre which may be a SNR (see also Cherepashchuk *et al.* 1994).
- A poorly defined possible SNR, near  $l = 151^\circ$ ,  $b = 3^\circ$  reported by Kerton, Murphy & Patterson (2007).
- Anderson *et al.* (2012) report extended radio emission, designated G333.9+0.0, near a magnetar, which may be a SNR.
- Five candidate remnants, G108.5+11.0, G128.5+2.6, G149.5+3.2, G150.8+3.8 and G160.1–1.1, are identified from radio surveys by Gerbrandt *et al.* (2014), see also Tung *et al.* (2017). One of these, G150.8+3.8, is part of SNR G150.3+4.5 (Gao & Han 2014), which was added in Version VIII of the catalogue.
- Sidorin *et al.* (2014) note that there is possibly non-thermal radio emission near  $l = 51^\circ$ ,  $b = 0^\circ$ , overlapping GLIMPSE IR bubble N107, which may indicate a SNR. More recently Supan *et al.* (2018) present radio and IR observations of this region, and suggest part of the non-thermal emission noted by Sidorin *et al.*, as a SNR. See also Anderson *et al.* (2017), Driessen *et al.* (2018) and Dokara *et al.* (2018).
- Kothes *et al.* (2014) report the discovery of a new PWN, G141.2+5.0, which lies within an HII cavity, which might be an indication of remnant. See also Reynolds & Borkowski (2016).
- Green, Reeves & Murphy (2014) list over twenty candidate SNRs identified in the second epoch Molonglo Galactic Plane Survey. Two of these, G296.7–0.9 and G308.4–1.4 were added in Version VII of the catalogue, and G323.7–1.0 was added in Version VIII, based on other available observations. Several of the others are previously reported candidate SNRs (e.g. Duncan *et al.* 1995; Whiteoak & Green 1996; Duncan *et al.* 1997).
- Demetroullas *et al.* (2015) suggest a region of radio emission, NGC 6334D (near  $l = 351.6^\circ$ ,  $b = 0.2^\circ$ ), seen in their 31-GHz observations, apparently with a non-thermal radio spectrum, might be a SNR. (Note that the coordinates of some figures in Demetroullas *et al.* are in error.) However, other available observations of this region do not support a SNR identification for NGC 6334D. Demetroullas *et al.* noted there are two sources in the Northern VLA Sky Survey (NVSS, Condon *et al.* 1998, at 1.4 GHz with a resolution of 45 arcsec) in the region of NGC 6334D, with peaks of 2.1 and 2.0 Jy beam<sup>-1</sup>. Each of these sources have integrated flux densities of about 3.8 Jy in the NVSS, and other observations (e.g. Murphy *et al.* 2007) show they have relatively flat radio spectra. They are each associated with one or more compact HII regions identified by Giveon *et al.* (2005), from higher resolution 5-GHz and IR observations. The NVSS sources are separated by about 4 arcmin, and – with flat radio spectra – explain the extended emission of NGC 6334D seen in Demetroullas *et al.*’s lower resolution 31-GHz image. Higher quality 1.4-GHz observations from the SGPS (Haverkorn *et al.* 2006) do not show any obvious emission, apart from that from the NVSS sources, in this region that might indicate a SNR.
- A sample of ‘giant radio sources’ identified in the NVSS is presented by Proctor (2016). One of these sources, NVGRC J205051.1+312728 is annotated as ‘SNR?’ (among other possibilities), but this is actually part of the Cygnus Loop (=G74.0–8.5, e.g. see Green 1990b). Several other of these sources also correspond to known SNRs, including other parts of the Cygnus Loop.



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- Bihr *et al.* (2016) present radio observations in the regions  $l = 14^{\circ}0-37^{\circ}9$  and  $l = 47^{\circ}1-51^{\circ}2$ ,  $|b| \leq 1^{\circ}1$ , from the THOR survey (e.g. Beuther *et al.* 2016). This includes many of the candidates in Helfand *et al.* (2006), and Bihr *et al.* identify several of these as HII regions. Anderson *et al.* (2017) use radio observations from THOR and VGPS, plus mid-IR observations, to identify 76 candidate remnants in  $17^{\circ}5 < l < 67^{\circ}4$ ,  $|b| \leq 1^{\circ}5$ . Several of which correspond to candidates previously identified by Helfand *et al.* (2016) from the MAGPIS survey (see above). Several of these candidates are small (less than  $2'$  in extent), and would be very young SNRs even if at the far side of the Galaxy. For several of these small candidates higher resolution radio observations are available from the MAGPIS survey (see: <https://third.ucllnl.org/gps/>), which do not support these as being young SNRs. For example, the candidate G38.83–0.01 from Anderson *et al.* (2017), given as a radius of  $0'.6$ , is resolved into 2 compact sources. See also Castelletti *et al.* (2017), Dokara *et al.* (2018), Driessen *et al.* (2018), Wang *et al.* (2018), Karpova, Zyuzin & Shibarov (2019), Maxted *et al.* (2019), Petriella *et al.* (2019), H.E.S.S. Collaboration: Abdalla *et al.* (2020) and Araya *et al.* (2021) for further observations of some of the candidates listed by Anderson *et al.* (2017). See also Ranasinghe, Leahy & Stil (2021).
  - Sushch *et al.* (2017) present radio observations that identify a possible SNR, G304.4–0.2.
  - Dzib *et al.* (2018) present observations of small (only  $\sim 15''$  in extent) radio shell, which they suggest may be a SNR. However, this source has already been identified as a candidate PN by Froebrich *et al.* (2015).
  - Hurley-Walker *et al.* (2019b) list many candidate SNRs in the regions  $345^{\circ} < l < 60^{\circ}$  and  $180 < l < 240^{\circ}$   $|b| < 10^{\circ}$  from the GaLactic and Extragalactic All-sky MWA (GLEAM) radio survey (Hurley-Walker *et al.* 2019c). Also, Hurley-Walker *et al.* (2019a) provide additional GLEAM observations of many previously proposed candidate SNRs.
  - Dokara *et al.* (2021) present radio observations in the region  $358^{\circ} \leq l \leq 60^{\circ}$ ,  $|b| \leq 1^{\circ}$ , which includes 157 candidate remnants, including many previously proposed candidates SNRs.
  - G351.7–1.2 a candidate remnant identified by Veena *et al.* (2019a) from radio and H $\alpha$  observations (see also Veena *et al.* 2019b).
  - Ingallinera *et al.* (2019) reported several possible remnants near  $l = 343^{\circ}5$ ,  $b = +0^{\circ}5$  from ATCA observations at 2.1 GHz.
  - Sofue (2020) identifies a small diameter hole in CO emission as a possible ‘dark’ SNR (see also Sofue 2021).
  - G270.4–1.0, a possible ‘filled-centre’ SNR, with a pulsar near its edge, identified at radio wavelengths by Johnston & Lower (2021). (Note: this possible new remnant is sometimes erroneously called G320.4–1.0 by Johnston & Lower.)
  - Pol *et al.* (2021) note a large ( $\sim 1^{\circ}5$ ) faint region of radio emission, which also shows some H $\alpha$  emission, which may be a SNR.

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### 2.3.2 UV/Optical/Infra-red

- Winkler *et al.* (1989) report a possible small (4 arcmin) SNR within the Puppis A remnant, from optical observations (see also Sutherland & Dopita 1995). This has not been detected at radio wavelengths (see Dubner *et al.* 1991). See also Ghavamian *et al.* (2019) who suggest this is due to the supernova shock from one binary member interacting with the other.
- G75.5+2.4, a possible large ( $1^{\circ}5 \times 1^{\circ}8$ ) old SNR in Cygnus suggested by Nichols-Bohlin & Fesen (1993) from infra-red and optical observations (see also Dewdney & Lozinskaya 1994; Marston 1996; Esipov *et al.* 1996; Kothes *et al.* 2006).
- Two possible SNRs, G340.5+0.7 and G342.1+0.1, identified by Walker, Zealey & Parker (2001) from filaments seen in H $\alpha$  survey observations. See also Stupar, Parker & Filipović (2008). The larger of these, G342.1+0.1, overlaps some catalogued SNRs.
- A possible SNR which was identified by Bally & Reipurth (2001) – which they label as G110.3+11.3 – from optical filaments. See also Rector & Schweiker (2013).
- A candidate remnant, noted by Mavromatakis & Strom (2002) from optical observations, which was labelled G70.5+1.9 by Mavromatakis *et al.* (2009). Kothes *et al.* (2006) do not find any radio counterpart from this source at 408 MHz or 1.4 GHz from the CGPS survey.
- A possible remnant identified from optical filaments to the NE of the known SNR G116.5+1.1, as observed by Mavromatakis *et al.* (2005).
- Russell *et al.* (2007) report a small (about 7 arcmin in extent) optical ring, which is very faint at radio wavelengths, just to the NW of Cygnus X-1 (see also Gallo *et al.* 2005). This may be a SNR if it is not associated with Cygnus X-1, although Sell *et al.* (2015) regard this as unlikely.
- Stupar, Parker & Filipović (2008) report several SNR candidates identified from H $\alpha$  observations, several of which correspond to SNR candidates first suggested by Duncan *et al.* (1995, 1997) from radio observations. The full extent of most of these are not well defined, but two are currently included in the main catalogue (G315.1+2.7, and G332.5–5.6). See also Stupar, Parker & Filipović (2010).
- Optical filaments indicating a possible new SNR, G304.4–3.1 are presented by Stupar, Parker & Filipović (2010).
- Stupar, Parker & Filipović (2011) report a possible new SNR, G310.5–0.8, identified from optical filaments and associated radio emission.

### 2.3.3 X-ray/ $\gamma$ -ray

- H1538–32 a large X-ray source in Lupus, near  $l = 340^\circ$ ,  $b = +18^\circ$  was identified as a possible SNR by Riegler, Agrawal & Gull (1980), see also Colomb, Dubner & Giacani (1984), Gahm *et al.* (1990). However, more recently Franco (2002) suggest it is instead a local X-ray enhancement.
- G189.6+3.3, a faint, possible SNR overlapping G189.1+3.0 (=IC443) identified by Asaoka & Aschenbach (1994) from ROSAT X-ray observations (see also Lee *et al.* 2008, Castelletti *et al.* 2011, Hurley-Walker *et al.* 2019a; Yamauchi *et al.* 2020).
- G117.7+0.6, a faint shell of soft X-ray emission near G116.9+0.2 (=CTB 1), which contains a pulsar (Hailey & Craig 1995; see also Craig, Hailey & Pisarski 1997, Kothes *et al.* 2006 and Esposito *et al.* 2008).
- A possible SNR identified in X-rays around the pulsar B1828–13 suggested by Finley, Srinivasan & Park (1996), see also Braun, Goss & Lyne (1989), Shan *et al.* (2018) and H.E.S.S. Collaboration: Abdalla *et al.* (2018a). But Pavlov, Kargaltsev & Brisken (2008) do not find any evidence for a remnant around B1828–13.
- A possible, large SNR, G69.4+1.2, identified as an X-ray shell by Yoshita, Miyata & Tsunemi (1999, 2000). See also Mavromatakis, Boumis & Paleologou (2002) and Kothes *et al.* (2006).
- Schaudel *et al.* (2002) report 14 candidate SNRs identified in the ROSAT All-Sky Survey, but provided images and coordinates for only 3 of these (which have been included in the catalogue, as G38.7–1.3, G296.7–0.9 and G308.4–1.4, following improved observations of them).
- Many possible SNRs near the Galactic Centre have been reported by various authors from X-ray observations (e.g. Senda, Murakami & Koyama 2002, 2003; Renaud *et al.* 2006; Koyama *et al.* 2007; Mori *et al.* 2008; Nobukawa *et al.* 2008; Inui *et al.* 2009; Tsuru *et al.* 2009; Heard & Warwick 2013; Ponti *et al.* 2015), which are reviewed by Koyama (2018). See also Law, Yusef-Zadeh & Cotton (2008), Dexter *et al.* (2017), Simpson (2018), Terrier *et al.* (2018), Yamauchi *et al.* (2018b), Henshaw *et al.* (2019), Lu *et al.* (2019), Paré *et al.* (2019), Ponti *et al.* (2019), Zhang *et al.* (2020a), Adams *et al.* (2021), Wang (2021) and Yusef-Zadeh *et al.* (2021).
- Several possible SNRs are reported by Bamba *et al.* (2003) and Ueno *et al.* (2005, 2006), two of which have been included in the catalogue (as G28.6–0.1 and G32.4+0.1), as additional observations confirm their nature. One of the proposed remnants is called G11.0+0.0, but is larger than the currently catalogued G11.0–0.0. One of these candidates, G37.0–0.1, has been identified as a cluster of Galaxies by Yamauchi, Bamba & Koyama (2011). The nature of another, G25.5+0.0, has been questioned by Kargaltsev *et al.* (2012), who also proposed another, smaller possible SNR, G25.25+0.28, which corresponds to one of the candidates listed by Helfand *et al.* (2006). For a third source, G23.5+0.1, Kargalstev *et al.* prefer a pulsar wind nebula interpretation. Yamauchi, Sumita & Bamba (2016) also identify G23.5+0.1 and G22.0+0.0 as pulsar wind nebulae. See also H.E.S.S. Collaboration: Abdalla *et al.* (2018a), MAGIC Collaboration: Acciari *et al.* (2020) and Dokara *et al.* (2021).
- Henley & Shelton (2009) report a possible large ( $\sim 10^\circ$ ) SNR at high Galactic latitudes, from the ROSAT All-Sky Survey.
- Brief details a possible new SNR identified from the Swift X-ray Galactic Plane Survey are reported by Reynolds *et al.* (2012).
- Nobukawa *et al.* (2015) present Suzaku observations which indicate a likely SNR near  $l = 26^\circ 4$ ,  $b = -0^\circ 2$ .
- Araya (2018) reports a large (greater than  $3^\circ$ ) region of  $\gamma$ -ray emission at  $l = 350^\circ 6$ ,  $b = -4^\circ 7$ , which may be a SNR.
- G116.6–26.1, a large ( $\sim 4^\circ$ ) region of faint X-ray emission identified as a candidate SNR by Churazov *et al.* (2021).

### 2.3.4 Other

- G287.8–0.5, which is associated with  $\eta$  Carinae, was listed in Version I as a SNR, but was removed from the catalogue in Version II as its parameters are uncertain (see Jones 1973; Retallack 1984; Tateyama, Strauss & Kaufmann 1991; and the discussion in Version II).
- G359.2–0.8 (the ‘mouse’), near the Galactic centre, which has been suggested as being analogous to the central region of G69.0+2.7 (=CTB 80) by Predehl & Kulkarni (1995), i.e. a pulsar powered nebula (see also Camilo *et al.* 2002).

It should also be noted: (a) Some large radio continuum, HI, CO or optical loops in the Galactic plane that may be parts of very large, old SNRs, but they have not been included in the See Berkhuijsen (1973), Grenier *et al.* (1989), Combi *et al.* (1995), Maciejewski *et al.* (1996), Kim & Koo (2000), Normandeau *et al.* (2000), Woermann, Gaylard & Otrupcek (2001), Stil & Irwin (2001), Uyaniker & Kothes (2002), Olano, Meschin & Niemela (2006), Borka (2007), Kang, Koo & Salter (2012), Xiao & Zhu (2014), Cichowolski *et al.* (2014), Sallmen *et al.* (2015), Bracco *et al.* (2020), Fesen *et al.* (2021) and Panopoulou *et al.* (2021). Gao & Han (2013) discuss the nature of the Origen Loop – a large radio loop – which has at times been regarded as a remnant. Also Koo, Kang & Salter (2006) and Kang & Koo (2007) identify faint Galactic HI features at forbidden velocities as indicators of old, otherwise undetectable SNRs. (b) Some large ( $> 10^\circ$ ) regions of X-ray emission that are indicative of a SNR are not included in the catalogue; e.g. the Monogem ring, near  $l = 203^\circ$ ,  $b = +12^\circ$  (see Nousek *et al.* 1981, Plucinsky *et al.* 1996, Thorsett *et al.* 2003, Amenomori *et al.* 2005, Plucinsky 2009, and references therein, plus Weinberger, Temporin & Stecklum 2006 and Reich, Reich & Sun 2020); in the Gum Nebula near  $l = 250^\circ$ ,  $b = 0^\circ$  (see Leahy, Nousek & Garmire 1992, and also see Reynolds 1976, Dubner *et al.* 1992, Duncan *et al.* 1996, Reynoso & Dubner 1997, Heiles 1998, Pagani *et al.* 2012, Purcell *et al.* 2015, Knies, Sasaki & Plucinsky 2018); in Eridanus near  $l = 200^\circ$ ,  $b = -40^\circ$  (see Naranan *et al.* 1976, Burrows *et al.* 1993, Snowden *et al.* 1995, Heiles 1998, Boumis *et al.* 2001, Ryu *et al.* 2006); a large approximately  $24^\circ$  diameter, X-ray and optical loop in Antlia (see McCullough, Fields & Pavlidou 2002, Shinn *et al.* 2007). (c) The distinction between filled-centre remnants and pulsar wind nebulae (PWNe) is not clear, and isolated, generally faint, pulsar wind nebulae are also not included in the catalogue. See the catalogue of PWNe by Kaspi, Roberts & Harding (2006) (also see <http://www.physics.mcgill.ca/~pulsar/pwncat.html>), and the high-energy SNR and PWNe catalogue noted at the end of Section 1.

### 2.4 Questionable SNRs listed in the catalogue

As noted in Versions II and IV of the catalogue, the following sources are listed as SNRs, although, as discussed in each case, the identifications are not certain: G5.4–1.2, G39.7–2.0 (=W50), G69.0+2.7 (=CTB 80), G318.9+0.4 and G357.7–0.1. The nature of G76.9+1.0 (an unusual radio source similar to G65.7+1.2), and of G354.1+0.1 (which may be similar to G357.7–0.1 (=MSH 17–39)) are also uncertain (see Landecker, Higgs & Wendker 1993 and Frail, Goss & Whiteoak 1994).

There are also some objects that have been identified as SNRs and are listed in the catalogue, although they have been barely resolved in the available observations, or are faint, and have not been well separated from confusing background or nearby thermal emission, and their identification as SNRs, or at least their parameters remain uncertain.

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$l$ /°	$b$ /°	RA (J2000.0) /(h m s)	Dec /(° ′)	size /arcmin	type	Flux at 1 GHz/Jy	spectral index	other name(s)
0.0	+0.0	17 45 44	-29 00	3.5×2.5	S	100?	0.8?	Sgr A East
0.3	+0.0	17 46 15	-28 38	15×8	S	22	0.6	
0.9	+0.1	17 47 21	-28 09	8	C	18?	varies	
1.0	-0.1	17 48 30	-28 09	8	S	15	0.6?	
1.4	-0.1	17 49 39	-27 46	10	S	2?	?	
1.9	+0.3	17 48 45	-27 10	1.5	S	0.6	0.6	
3.1	-0.6	17 55 30	-26 35	52×28	S	5	0.9?	
3.7	-0.2	17 55 26	-25 50	14×11	S	2.3	0.65	
3.8	+0.3	17 52 55	-25 28	18	S?	3?	0.6	
4.2	-3.5	18 08 55	-27 03	28	S	3.2?	0.6?	
4.5	+6.8	17 30 42	-21 29	3	S	19	0.64	Kepler, SN1604, 3C358
4.8	+6.2	17 33 25	-21 34	18	S	3	0.6	
5.2	-2.6	18 07 30	-25 45	18	S	2.6?	0.6?	
5.4	-1.2	18 02 10	-24 54	35	C?	35?	0.2?	Milne 56
5.5	+0.3	17 57 04	-24 00	15×12	S	5.5	0.7	
5.9	+3.1	17 47 20	-22 16	20	S	3.3?	0.4?	
6.1	+0.5	17 57 29	-23 25	18×12	S	4.5	0.9	
6.1	+1.2	17 54 55	-23 05	30×26	F	4.0?	0.3?	
6.4	-0.1	18 00 30	-23 26	48	C	310	varies	W28
6.4	+4.0	17 45 10	-21 22	31	S	1.3?	0.4?	
6.5	-0.4	18 02 11	-23 34	18	S	27	0.6	
7.0	-0.1	18 01 50	-22 54	15	S	2.5?	0.5?	
7.2	+0.2	18 01 07	-22 38	12	S	2.8	0.6	
7.5	-1.7	18 10 00	-23 10	100	S	18?	0.7?	
7.7	-3.7	18 17 25	-24 04	22	S	11	0.32	1814-24
8.7	-5.0	18 24 10	-23 48	26	S	4.4	0.3	
8.7	-0.1	18 05 30	-21 26	45	S?	80	0.5	(W30)
8.9	+0.4	18 03 58	-21 03	24	S	9	0.6	
9.7	-0.0	18 07 22	-20 35	15×11	S	3.7	0.6	
9.8	+0.6	18 05 08	-20 14	12	S	3.9	0.5	
9.9	-0.8	18 10 41	-20 43	12	S	6.7	0.4	
11.0	-0.0	18 10 04	-19 25	11×9	S	1.3	0.6	
11.1	-0.7	18 12 46	-19 38	11×7	S	1.0	0.7	
11.1	+0.1	18 09 47	-19 12	12×10	S	2.3	0.4	
11.2	-0.3	18 11 27	-19 25	4	C	22	0.5	
11.4	-0.1	18 10 47	-19 05	8	S?	6	0.5	
11.8	-0.2	18 12 25	-18 44	4	S	0.7	0.3	
12.0	-0.1	18 12 11	-18 37	7?	?	3.5	0.7	
12.2	+0.3	18 11 17	-18 10	6×5	S	0.8	0.7	
12.5	+0.2	18 12 14	-17 55	6×5	C?	0.6	0.4	
12.7	-0.0	18 13 19	-17 54	6	S	0.8	0.8	
12.8	-0.0	18 13 37	-17 49	3	C?	0.8	0.5	
13.1	-0.5	18 16 00	-17 49	38×28	S	11?	0.6?	
13.3	-1.3	18 19 20	-18 00	70×40	S?	?	?	
13.5	+0.2	18 14 14	-17 12	5×4	S	3.5?	1.0?	

$l$ /°	$b$ /°	RA (J2000.0) /(h m s)	Dec /(° ′)	size /arcmin	type	Flux at 1 GHz/Jy	spectral index	other name(s)
14.1	-0.1	18 16 40	-16 41	6×5	S	0.5	0.6	
15.1	-1.6	18 24 00	-16 34	30×24	S?	5.5?	0.0?	
15.4	+0.1	18 18 02	-15 27	15×14	C?	5.6	0.62	
15.5	-0.1	18 19 25	-15 32	9×8	?	1.2?	0.55?	
15.9	+0.2	18 18 52	-15 02	7×5	S?	5.0	0.63	
16.0	-0.5	18 21 56	-15 14	15×10	S	2.7	0.6	
16.2	-2.7	18 29 40	-16 08	17	S	2.5	0.4	
16.7	+0.1	18 20 56	-14 20	4	C	3.0	0.6	
17.0	-0.0	18 21 57	-14 08	5	S	0.5	0.5	
17.4	-2.3	18 30 55	-14 52	24?	S	5	0.5?	
17.4	-0.1	18 23 08	-13 46	6	S	0.4	0.7	
17.8	-2.6	18 32 50	-14 39	24	S	5	0.5	
18.1	-0.1	18 24 34	-13 11	8	S	4.6	0.5	
18.6	-0.2	18 25 55	-12 50	6	S	1.4	0.4	
18.8	+0.3	18 23 58	-12 23	17×11	S	33	0.46	Kes 67
18.9	-1.1	18 29 50	-12 58	33	C?	37	0.39	
19.1	+0.2	18 24 56	-12 07	27	S	10	0.5	
20.0	-0.2	18 28 07	-11 35	10	F	10	0.1	
21.0	-0.4	18 31 12	-10 47	9×7	S	1.1	0.6	
21.5	-0.9	18 33 33	-10 35	5	C	7	varies	
21.6	-0.8	18 33 40	-10 25	13	S	1.4	0.5?	
21.8	-3.0	18 41 50	-11 16	60	S	5	0.7	
21.8	-0.6	18 32 45	-10 08	20	S	65	0.56	Kes 69
22.7	-0.2	18 33 15	-09 13	26	S?	33	0.6	
23.3	-0.3	18 34 45	-08 48	27	S	70	0.5	W41
24.7	-0.6	18 38 43	-07 32	15?	S?	8	0.5	
24.7	+0.6	18 34 10	-07 05	30×15	C?	20?	0.2?	
25.1	-2.3	18 45 10	-08 00	80×30?	S	8	0.5?	
27.4	+0.0	18 41 19	-04 56	4	S	6	0.68	4C-04.71
27.8	+0.6	18 39 50	-04 24	50×30	F	30	varies	
28.3	+0.2	18 42 30	-03 58	10	S	1.3?	0.7?	
28.6	-0.1	18 43 55	-03 53	13×9	S	3?	?	
28.7	-0.4	18 45 30	-03 54	9	S	0.9?	0.8?	
28.8	+1.5	18 39 00	-02 55	100?	S?	?	0.4?	
29.6	+0.1	18 44 52	-02 57	5	S	1.5?	0.5?	
29.7	-0.3	18 46 25	-02 59	3	C	10	0.63	Kes 75
30.7	-2.0	18 54 25	-02 54	16	?	0.5?	0.7?	
30.7	+1.0	18 44 00	-01 32	24×18	S?	6	0.4	
31.5	-0.6	18 51 10	-01 31	18?	S?	2?	?	
31.9	+0.0	18 49 25	-00 55	7×5	S	25	varies	3C391
32.0	-4.9	19 06 00	-03 00	60?	S?	22?	0.5?	3C396.1
32.1	-0.9	18 53 10	-01 08	40?	C?	?	?	
32.4	+0.1	18 50 05	-00 25	6	S	0.25?	?	
32.8	-0.1	18 51 25	-00 08	22×15	S?	11?	0.2?	Kes 78
33.2	-0.6	18 53 50	-00 02	18	S	3.5	varies	

$l$ /°	$b$ /°	RA (J2000.0) /(h m s)	Dec /(° ′)	size /arcmin	type	Flux at 1 GHz/Jy	spectral index	other name(s)
33.6	+0.1	18 52 48	+00 41	10	S	20	0.51	Kes 79, 4C00.70, HC13
34.7	−0.4	18 56 00	+01 22	35×27	C	240	0.37	W44, 3C392
35.6	−0.4	18 57 55	+02 13	15×11	S?	9	0.5	
36.6	−0.7	19 00 35	+02 56	25?	S?	1.0	0.7?	
36.6	+2.6	18 48 49	+04 26	17×13?	S	0.7?	0.5?	
38.7	−1.3	19 06 40	+04 28	32×19?	S	?	?	
39.2	−0.3	19 04 08	+05 28	8×6	C	18	0.34	3C396, HC24, NRAO 593
39.7	−2.0	19 12 20	+04 55	120×60	?	85?	0.7?	W50, SS433
40.5	−0.5	19 07 10	+06 31	22	S	11	0.4	
41.1	−0.3	19 07 34	+07 08	4.5×2.5	S	25	0.50	3C397
41.5	+0.4	19 05 50	+07 46	10	S?	1?	?	
42.0	−0.1	19 08 10	+08 00	8	S?	0.5?	?	
42.8	+0.6	19 07 20	+09 05	24	S	3?	0.5?	
43.3	−0.2	19 11 08	+09 06	4×3	S	38	0.46	W49B
43.9	+1.6	19 05 50	+10 30	60?	S?	9.0	0.5	
45.7	−0.4	19 16 25	+11 09	22	S	4.2?	0.4?	
46.8	−0.3	19 18 10	+12 09	15	S	17	0.54	(HC30)
49.2	−0.7	19 23 50	+14 06	30	S?	160?	0.3?	(W51)
53.4	+0.0	19 29 57	+18 10	10?	S	1.5	0.6?	
53.6	−2.2	19 38 50	+17 14	33×28	S	8	0.50	3C400.2, NRAO 611
54.1	+0.3	19 30 31	+18 52	12?	C?	0.5	0.1	
54.4	−0.3	19 33 20	+18 56	40	S	28	0.5	(HC40)
55.0	+0.3	19 32 00	+19 50	20×15?	S	0.5?	0.5?	
55.7	+3.4	19 21 20	+21 44	23	S	1?	0.3?	
57.2	+0.8	19 34 59	+21 57	12?	S?	1.8	0.35	(4C21.53)
59.5	+0.1	19 42 33	+23 35	15	S	3?	?	
63.7	+1.1	19 47 52	+27 45	8	F	1.8	0.24	
64.5	+0.9	19 50 25	+28 16	8	S?	0.15?	0.5	
65.1	+0.6	19 54 40	+28 35	90×50	S	5.5	0.61	
65.3	+5.7	19 33 00	+31 10	310×240	S?	42	0.6	
65.7	+1.2	19 52 10	+29 26	22	F	5.1	varies	DA 495
66.0	−0.0	19 57 50	+29 03	31×25?	S	?	?	
67.6	+0.9	19 57 45	+30 53	50×45?	S	?	?	
67.7	+1.8	19 54 32	+31 29	15×12	S	1.0	0.61	
67.8	+0.5	20 00 00	+30 51	7×5	?	?	?	
68.6	−1.2	20 08 40	+30 37	23	?	1.1	0.2	
69.0	+2.7	19 53 20	+32 55	80?	?	120?	varies	CTB 80
69.7	+1.0	20 02 40	+32 43	16×14	S	2.0	0.7	
70.0	−21.5	21 24 00	+19 23	330×240	S	?	?	
73.9	+0.9	20 14 15	+36 12	27	S?	9	0.23	
74.0	−8.5	20 51 00	+30 40	230×160	S	210	varies	Cygnus Loop
74.9	+1.2	20 16 02	+37 12	8×6	F	9	varies	CTB 87
76.9	+1.0	20 22 20	+38 43	9	C	2?	?	
78.2	+2.1	20 20 50	+40 26	60	S	320	0.51	DR4, $\gamma$ Cygni SNR
82.2	+5.3	20 19 00	+45 30	95×65	S	120?	0.5?	W63

$l$ /°	$b$ /°	RA (J2000.0) /(h m s)	Dec /(° ′)	size /arcmin	type	Flux at 1 GHz/Jy	spectral index	other name(s)
83.0	−0.3	20 46 55	+42 52	9×7	S	1	0.4	
84.2	−0.8	20 53 20	+43 27	20×16	S	11	0.5	
85.4	+0.7	20 50 40	+45 22	24?	S	?	0.2	
85.9	−0.6	20 58 40	+44 53	24	S	?	0.2	
89.0	+4.7	20 45 00	+50 35	120×90	S	220	0.38	HB21
93.3	+6.9	20 52 25	+55 21	27×20	C?	9	0.45	DA 530, 4C(T)55.38.1
93.7	−0.2	21 29 20	+50 50	80	S	65	0.65	CTB 104A, DA 551
94.0	+1.0	21 24 50	+51 53	30×25	S	13	0.45	3C434.1
96.0	+2.0	21 30 30	+53 59	26	S	0.35	0.6	
106.3	+2.7	22 27 30	+60 50	60×24	C?	6	0.6	
107.0	+9.0	22 01 00	+66 30	180?	?	11?	0.9?	
108.2	−0.6	22 53 40	+58 50	70×54	S	8	0.5	
109.1	−1.0	23 01 35	+58 53	28	S	20	0.45	CTB 109
111.7	−2.1	23 23 26	+58 48	5	S	2300	0.77	Cassiopeia A, 3C461
113.0	+0.2	23 26 50	+61 26	40×17?	?	4	0.5?	
114.3	+0.3	23 37 00	+61 55	90×55	S	5.5	0.5	
116.5	+1.1	23 53 40	+63 15	80×60	S	10	0.5	
116.9	+0.2	23 59 10	+62 26	34	S	8	0.57	CTB 1
119.5	+10.2	00 06 40	+72 45	90?	S	36	0.6	CTA 1
120.1	+1.4	00 25 18	+64 09	8	S	50	0.58	Tycho, 3C10, SN1572
126.2	+1.6	01 22 00	+64 15	70	S?	6	0.5	
127.1	+0.5	01 28 20	+63 10	45	S	12	0.45	R5
130.7	+3.1	02 05 41	+64 49	9×5	F	33	0.07	3C58, SN1181
132.7	+1.3	02 17 40	+62 45	80	S	45	0.6	HB3
150.3	+4.5	04 27 00	+55 28	180×150	S	?	?	
152.4	−2.1	04 07 50	+49 11	100×95	S	3.5?	0.7?	
156.2	+5.7	04 58 40	+51 50	110	S	5	0.5	
159.6	+7.3	05 20 00	+50 00	240×180?	S	?	?	
160.9	+2.6	05 01 00	+46 40	140×120	S	110	0.64	HB9
166.0	+4.3	05 26 30	+42 56	55×35	S	7	0.37	VRO 42.05.01
178.2	−4.2	05 25 05	+28 11	72×62	S	2	0.5	
179.0	+2.6	05 53 40	+31 05	70	S?	7	0.4	
180.0	−1.7	05 39 00	+27 50	180	S	65	varies	S147
181.1	+9.5	06 26 40	+32 30	74	S	0.4?	0.4?	
182.4	+4.3	06 08 10	+29 00	50	S	0.5	0.4	
184.6	−5.8	05 34 31	+22 01	7×5	F	900	0.30	Crab Nebula, 3C144, SN1054
189.1	+3.0	06 17 00	+22 34	45	C	165	0.36	IC443, 3C157
190.9	−2.2	06 01 55	+18 24	70×60	S	1.3?	0.7?	
205.5	+0.5	06 39 00	+06 30	220	S	140	0.4	Monoceros Nebula
206.9	+2.3	06 48 40	+06 26	60×40	S?	6	0.5	PKS 0646+06
213.0	−0.6	06 50 50	−00 30	160×140?	S	21	0.4	
249.5	+24.5	09 34 00	−17 00	260	S	27	0.7	Hoinga
260.4	−3.4	08 22 10	−43 00	60×50	S	130	0.5	Puppis A, MSH 08–44
261.9	+5.5	09 04 20	−38 42	40×30	S	10?	0.4?	
263.9	−3.3	08 34 00	−45 50	255	C	1750	varies	Vela (XYZ)

$l$ /°	$b$ /°	RA (J2000.0) /(h m s)	Dec /(° ′)	size /arcmin	type	Flux at 1 GHz/Jy	spectral index	other name(s)
266.2	-1.2	08 52 00	-46 20	120	S	50?	0.3?	RX J0852.0-4622
272.2	-3.2	09 06 50	-52 07	15?	S?	0.4	0.6	
279.0	+1.1	09 57 40	-53 15	95	S	30?	0.6?	
284.3	-1.8	10 18 15	-59 00	24?	S	11?	0.3?	MSH 10-53
286.5	-1.2	10 35 40	-59 42	26×6	S?	1.4?	?	
289.7	-0.3	11 01 15	-60 18	18×14	S	6.2	0.2?	
290.1	-0.8	11 03 05	-60 56	19×14	S	42	0.4	MSH 11-61A
291.0	-0.1	11 11 54	-60 38	15×13	C	16	0.29	(MSH 11-62)
292.0	+1.8	11 24 36	-59 16	12×8	C	15	0.4	MSH 11-54
292.2	-0.5	11 19 20	-61 28	20×15	S	7	0.5	
293.8	+0.6	11 35 00	-60 54	20	C	5?	0.6?	
294.1	-0.0	11 36 10	-61 38	40	S	>2?	?	
296.1	-0.5	11 51 10	-62 34	37×25	S	8?	0.6?	
296.5	+10.0	12 09 40	-52 25	90×65	S	48	0.5	PKS 1209-51/52
296.7	-0.9	11 55 30	-63 08	15×8	S	3	0.5	
296.8	-0.3	11 58 30	-62 35	20×14	S	9	0.6	1156-62
298.5	-0.3	12 12 40	-62 52	5?	?	5?	0.4?	
298.6	-0.0	12 13 41	-62 37	12×9	S	5?	0.3	
299.2	-2.9	12 15 13	-65 30	18×11	S	0.5?	?	
299.6	-0.5	12 21 45	-63 09	13	S	1.0?	?	
301.4	-1.0	12 37 55	-63 49	37×23	S	2.1?	?	
302.3	+0.7	12 45 55	-62 08	17	S	5?	0.4?	
304.6	+0.1	13 05 59	-62 42	8	S	14	0.5	Kes 17
306.3	-0.9	13 21 50	-63 34	4	S?	0.16?	0.5?	
308.1	-0.7	13 37 37	-63 04	13	S	1.2?	?	
308.4	-1.4	13 41 30	-63 44	12×6?	S?	0.4?	?	
308.8	-0.1	13 42 30	-62 23	30×20?	C?	15?	0.4?	
309.2	-0.6	13 46 31	-62 54	15×12	S	7?	0.4?	
309.8	+0.0	13 50 30	-62 05	25×19	S	17	0.5	
310.6	-1.6	14 00 45	-63 26	2.5	C?	?	?	
310.6	-0.3	13 58 00	-62 09	8	S	5?	?	Kes 20B
310.8	-0.4	14 00 00	-62 17	12	S	6?	?	Kes 20A
311.5	-0.3	14 05 38	-61 58	5	S	3?	0.5	
312.4	-0.4	14 13 00	-61 44	38	S	45	0.36	
312.5	-3.0	14 21 00	-64 12	20×18	S	3.5?	?	
315.1	+2.7	14 24 30	-57 50	190×150	S	?	?	
315.4	-2.3	14 43 00	-62 30	42	S	49	0.6	RCW 86, MSH 14-63
315.4	-0.3	14 35 55	-60 36	24×13	?	8	0.4	
315.9	-0.0	14 38 25	-60 11	25×14	S	0.8?	?	
316.3	-0.0	14 41 30	-60 00	29×14	S	20?	0.4	(MSH 14-57)
317.3	-0.2	14 49 40	-59 46	11	S	4.7?	?	
318.2	+0.1	14 54 50	-59 04	40×35	S	>3.9?	?	
318.9	+0.4	14 58 30	-58 29	30×14	C	4?	0.2?	
320.4	-1.2	15 14 30	-59 08	35	C	60?	0.4	MSH 15-52, RCW 89
320.6	-1.6	15 17 50	-59 16	60×30	S	?	?	



$l$ /°	$b$ /°	RA (J2000.0) /(h m s)	Dec /(° ′)	size /arcmin	type	Flux at 1 GHz/Jy	spectral index	other name(s)
321.9	-1.1	15 23 45	-58 13	28	S	>3.4?	?	
321.9	-0.3	15 20 40	-57 34	31×23	S	13	0.3	
322.1	+0.0	15 20 49	-57 10	8×4.5?	S?	?	?	
322.5	-0.1	15 23 23	-57 06	15	C	1.5	0.4	
323.5	+0.1	15 28 42	-56 21	13	S	3?	0.4?	
323.7	-1.0	15 34 30	-57 12	51×38	S	?	?	
326.3	-1.8	15 53 00	-56 10	38	C	145	varies	MSH 15–56
327.1	-1.1	15 54 25	-55 09	18	C	7?	?	
327.2	-0.1	15 50 55	-54 18	5	S	0.4	?	
327.4	+0.4	15 48 20	-53 49	21	S	30?	0.6	Kes 27
327.4	+1.0	15 46 48	-53 20	14	S	1.9?	?	
327.6	+14.6	15 02 50	-41 56	30	S	19	0.6	SN1006, PKS 1459–41
328.4	+0.2	15 55 30	-53 17	5	F	15	0.0	(MSH 15–57)
329.7	+0.4	16 01 20	-52 18	40×33	S	>34?	?	
330.0	+15.0	15 10 00	-40 00	180?	S	350?	0.5?	Lupus Loop
330.2	+1.0	16 01 06	-51 34	11	S?	5?	0.3	
332.0	+0.2	16 13 17	-50 53	12	S	8?	0.5	
332.4	-0.4	16 17 33	-51 02	10	S	28	0.5	RCW 103
332.4	+0.1	16 15 20	-50 42	15	S	26	0.5	MSH 16–51, Kes 32
332.5	-5.6	16 43 20	-54 30	35	S	2?	0.7?	
335.2	+0.1	16 27 45	-48 47	21	S	16	0.5	
336.7	+0.5	16 32 11	-47 19	14×10	S	6	0.5	
337.0	-0.1	16 35 57	-47 36	1.5	S	1.5	0.6?	(CTB 33)
337.2	-0.7	16 39 28	-47 51	6	S	1.5	0.4	
337.2	+0.1	16 35 55	-47 20	3×2	?	1.5?	?	
337.3	+1.0	16 32 39	-46 36	15×12	S	16	0.55	Kes 40
337.8	-0.1	16 39 01	-46 59	9×6	S	15	0.5	Kes 41
338.1	+0.4	16 37 59	-46 24	15?	S	4?	0.4	
338.3	-0.0	16 41 00	-46 34	8	C?	7?	?	
338.5	+0.1	16 41 09	-46 19	9	?	12?	?	
340.4	+0.4	16 46 31	-44 39	10×7	S	5	0.4	
340.6	+0.3	16 47 41	-44 34	6	S	5?	0.4?	
341.2	+0.9	16 47 35	-43 47	22×16	C	1.5?	0.6?	
341.9	-0.3	16 55 01	-44 01	7	S	2.5	0.5	
342.0	-0.2	16 54 50	-43 53	12×9	S	3.5?	0.4?	
342.1	+0.9	16 50 43	-43 04	10×9	S	0.5?	?	
343.0	-6.0	17 25 00	-46 30	250	S	?	?	RCW 114
343.1	-2.3	17 08 00	-44 16	32?	C?	8?	0.5?	
343.1	-0.7	17 00 25	-43 14	27×21	S	7.8	0.55	
344.7	-0.1	17 03 51	-41 42	8	C?	2.5?	0.3?	
345.1	-0.2	17 05 21	-41 26	6	S	1.4?	0.7?	
345.1	+0.2	17 03 40	-41 05	10	S	0.6?	0.6?	
345.7	-0.2	17 07 20	-40 53	6	S	0.6?	?	
346.6	-0.2	17 10 19	-40 11	8	S	8?	0.5?	
347.3	-0.5	17 13 50	-39 45	65×55	S?	30?	?	RX J1713.7–3946

$l$ /°	$b$ /°	RA (J2000.0) /(h m s)	Dec /(° ′)	size /arcmin	type	Flux at 1 GHz/Jy	spectral index	other name(s)
348.5	−0.0	17 15 26	−38 28	10?	S?	10?	0.4?	
348.5	+0.1	17 14 06	−38 32	15	S	72	0.3	CTB 37A
348.7	+0.3	17 13 55	−38 11	17?	S	26	0.3	CTB 37B
348.8	+1.1	17 11 29	−37 36	10	S	0.6?	0.7?	
349.2	−0.1	17 17 15	−38 04	9×6	S	1.4?	?	
349.7	+0.2	17 17 59	−37 26	2.5×2	S	20	0.5	
350.0	−2.0	17 27 50	−38 32	45	S	26	0.4	
350.1	−0.3	17 21 05	−37 27	4?	?	6?	0.8?	
351.0	−5.4	17 46 00	−39 25	30	S	?	?	
351.2	+0.1	17 22 27	−36 11	7	C?	5?	0.4	
351.7	+0.8	17 21 00	−35 27	18×14	S	10	0.5?	
351.9	−0.9	17 28 52	−36 16	12×9	S	1.8?	?	
352.7	−0.1	17 27 40	−35 07	8×6	S	4	0.6	
353.3	−1.1	17 33 10	−35 12	60	S	24?	0.85?	
353.6	−0.7	17 32 00	−34 44	30	S	2.5?	?	
353.9	−2.0	17 38 55	−35 11	13	S	1?	0.5?	
354.1	+0.1	17 30 28	−33 46	15×3?	C?	?	varies	
354.8	−0.8	17 36 00	−33 42	19	S	2.8?	?	
355.4	+0.7	17 31 20	−32 26	25	S	5?	?	
355.6	−0.0	17 35 16	−32 38	8×6	S	3?	?	
355.9	−2.5	17 45 53	−33 43	13	S	8	0.5	
356.2	+4.5	17 19 00	−29 40	25	S	4	0.7	
356.3	−1.5	17 42 35	−32 52	20×15	S	3?	?	
356.3	−0.3	17 37 56	−32 16	11×7	S	3?	?	
357.7	−0.1	17 40 29	−30 58	8×3?	?	37	0.4	MSH 17–39
357.7	+0.3	17 38 35	−30 44	24	S	10	0.4?	
358.0	+3.8	17 26 00	−28 36	38	S	1.5?	?	
358.1	+1.0	17 37 00	−29 59	20	S	2?	?	
358.5	−0.9	17 46 10	−30 40	17	S	4?	?	
359.0	−0.9	17 46 50	−30 16	23	S	23	0.5	
359.1	−0.5	17 45 30	−29 57	24	S	14	0.4?	
359.1	+0.9	17 39 36	−29 11	12×11	S	2?	?	
359.2	−1.1	17 48 14	−30 12	5×4	S?	0.4?	1.1?	

$\gamma$ Cygni SNR G78.2+2.1	HB3 G132.7+1.3	NRAO 593 G39.2-0.3
	HB9 G160.9+2.6	NRAO 611 G53.6-2.2
1156-62 G296.8-0.3	HB21 G89.0+4.7	
1814-24 G7.7-3.7		PKS 0646+06 G206.9+2.3
	HC13 G33.6+0.1	PKS 1209-51/52 G296.5+10.0
3C10 G120.1+1.4	HC24 G39.2-0.3	PKS 1459-41 G327.6+14.6
3C58 G130.7+3.1	(HC30) G46.8-0.3	
3C144 G184.6-5.8	(HC40) G54.4-0.3	Puppis A G260.4-3.4
3C157 G189.1+3.0		
3C358 G4.5+6.8	Hoinga G249.5+24.5	R5 G127.1+0.5
3C391 G31.9+0.0		
3C392 G34.7-0.4	IC443 G189.1+3.0	RCW 86 G315.4-2.3
3C396 G39.2-0.3		RCW 89 G320.4-1.2
3C396.1 G32.0-4.9	Kepler G4.5+6.8	RCW 103 G332.4-0.4
3C397 G41.1-0.3		RCW 114 G343.0-6.0
3C400.2 G53.6-2.2	Kes 17 G304.6+0.1	
3C434.1 G94.0+1.0	Kes 20A G310.6-0.3	RX J0852.0-4622 G266.2-1.2
3C461 G111.7-2.1	Kes 20B G310.8-0.4	RX J1713.7-3946 G347.3-0.5
	Kes 27 G327.4+0.4	
4C-04.71 G27.4+0.0	Kes 32 G332.4+0.1	S147 G180.0-1.7
4C00.70 G33.6+0.1	Kes 40 G337.3+1.0	
(4C21.53) G57.2+0.8	Kes 41 G337.8-0.1	SN1006 G327.6+14.6
4C(T)55.38.1 G93.3+6.9	Kes 67 G18.8+0.3	SN1054 G184.6-5.8
	Kes 69 G21.8-0.6	SN1181 G130.7+3.1
	Kes 75 G29.7-0.3	SN1572 G120.1+1.4
CTA 1 G119.5+10.2	Kes 78 G32.8-0.1	SN1604 G4.5+6.8
	Kes 79 G33.6+0.1	
CTB 1 G116.9+0.2		SS433 G39.7-2.0
(CTB 33) G337.0-0.1		
CTB 37A G348.5+0.1	Lupus Loop G330.0+15.0	
CTB 37B G348.7+0.3		Sgr A East G0.0+0.0
CTB 80 G69.0+2.7	MSH 08-44 G260.4-3.4	
CTB 87 G74.9+1.2	MSH 10-53 G284.3-1.8	Tycho G120.1+1.4
CTB 104A G93.7-0.2	MSH 11-54 G292.0+1.8	
CTB 109 G109.1-1.0	MSH 11-61A G290.1-0.8	Vela (XYZ) G263.9-3.3
	(MSH 11-62) G291.0-0.1	
Cassiopeia A G111.7-2.1	(MSH 14-57) G316.3-0.0	VRO 42.05.01 G166.0+4.3
	MSH 14-63 G315.4-2.3	
Crab Nebula G184.6-5.8	MSH 15-52 G320.4-1.2	W28 G6.4-0.1
	MSH 15-56 G326.3-1.8	(W30) G8.7-0.1
Cygnus Loop G74.0-8.5	(MSH 15-57) G328.4+0.2	W41 G23.3-0.3
	MSH 16-51 G332.4+0.1	W44 G34.7-0.4
DA 495 G65.7+1.2	MSH 17-39 G357.7-0.1	W49B G43.3-0.2
DA 530 G93.3+6.9		W50 G39.7-2.0
DA 551 G93.7-0.2	Milne 56 G5.4-1.2	(W51) G49.2-0.7
		W63 G82.2+5.3
DR4 G78.2+2.1	Monoceros Nebula G205.5+0.5	

**Journals**

AcASn	Acta Astronomica Sinica
AdSpR	Advances in Space Research
A&A	Astronomy & Astrophysics
A&AS	Astronomy & Astrophysics Supplement
AJ	Astronomical Journal
AN	Astronomische Nachrichten
ApJ	Astrophysical Journal
ApJS	Astrophysical Journal Supplement
Ap&SS	Astrophysics & Space Science
ARep	Astronomy Reports
AstL	Astronomy Letters
ATel	The Astronomer's Telegram
AuJPA	Australian Journal of Physics Astrophysical Supplement
AuJPh	Australian Journal of Physics
BAAA	Boletín de la Asociación Argentina de Astronomía
BASI	Bulletin of the Astronomical Society of India
BSAO	Bulletin of the Special Astrophysics Observatory
ChJAA	Chinese Journal of Astronomy & Astrophysics
CSci	Current Science
JApA	Journal of Astrophysics & Astronomy
JHEAp	Journal of High Energy Astrophysics
JKAS	Journal of Korean Astronomical Society
JPhCS	Journal of Physics Conference Series
MNRAS	Monthly Notices of the Royal Astronomical Society
NatAs	Nature Astronomy
NuPhS	Nuclear Physics B Proceedings Supplements
PASA	Proceedings of the Astronomical Society of Australia
PASJ	Publications of the Astronomical Society of Japan
PASP	Publications of the Astronomical Society of the Pacific
P&SS	Planetary and Space Science
RAA	Research in Astronomy & Astrophysics
RMxAA	Revista Mexicana de Astronomía y Astrofísica
SerAJ	Serbian Astronomical Journal
SvA	Soviet Astronomy
SvAL	Soviet Astronomy Letters

**Proceedings etc.**

ASPC	Astronomical Society of the Pacific (ASP) Conference Series
EFXU	is 'Suzaku-MAXI 2014: Expanding the Frontiers of the X-ray Universe', eds Ishida M., Petre R. & Mitsuda K., 2014.
IAUCo	International Astronomical Union (IAU) Colloquium
IAUS	International Astronomical Union (IAU) Symposium
LNP	Lecture Notes in Physics
MIM	is 'The Magnetized Interstellar Medium', eds Uyaniker B., Reich W. & Wielebinski R., (Copernicus GmbH, Katlenburg-Lindau), 2004.
NSPS	is 'Neutron Stars, Pulsars, and Supernova Remnants', (MPE Report 278), eds Becker W., Lesch H. & Trümper J., (Max-Planck-Institut für extraterrestrische Physik, Garching bei München), 2002.
XRRC	is 'X-Ray and Radio Connections', eds Sjouwerman L. O. & Dyer K. K., (available at <a href="http://www.aoc.nrao.edu/events/xraydio/">http://www.aoc.nrao.edu/events/xraydio/</a> ), 2005.

**Radio Telescopes/Surveys**

ALMA	Atacama Large Millimeter Array
ATCA	Australia Telescope Compact Array
BIMA	Berkeley–Illinois–Maryland Array
CGPS	Canadian Galactic Plane Survey
CLFST	Cambridge Low-Frequency Synthesis Telescope
DRAO	Dominion Radio Astrophysical Observatory
FAST	Five-hundred-meter Aperture Spherical Telescope
FIRST	Fleurs Synthesis Telescope
GBT	Green Bank Telescope
LOFAR	Low-Frequency Array
MOST	Molonglo Observatory Synthesis Telescope
MWA	Murchison Widefield Array
NRAO	National Radio Astronomy Observatory
NRO	Nobeyama Radio Observatory
SGPS	Southern Galactic Plane Survey
SRT	Sardinia Radio Telescope
TPT	Clark Lake Teepee-Tee telescope
VGPS	VLA Galactic Plane Survey
VLA	Very Large Array
WSRT	Westerbork Synthesis Radio Telescope

**Satellites**

Optical/IR:	Akari, Gaia, Herschel (also sub-mm), HST (Hubble Space Telescope), ISO (Infrared Space Observatory), IRAS (Infrared Astronomical Satellite), Spitzer, WISE (Wide-field Infrared Survey Explorer).
X-/ $\gamma$ -ray:	ASCA (Advanced Satellite for Cosmology and Astrophysics), BeppoSAX, Chandra, Einstein, eROSITA, EXOSAT (European X-ray Observatory Satellite), Fermi, Ginga, H.E.S.S. (High Energy Stereoscopic System), Hitomi, INTEGRAL (International Gamma-Ray Astrophysics Laboratory), NuSTAR (Nuclear Spectroscopic Telescope Array), ROSAT (Röntgensatellit), RXTE (Rossi X-ray Timing Explorer), Suzaku, Swift, XMM-Newton (X-ray Multi-Mirror).