X-RAY IMAGES OF SUPERNOVA REMNANTS

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Einstein observations of supernova remnants have been reviewed and analyzed. Images of 44 galactic remnants have been reprocessed, merged when necessary, and collected into a catalog. Some bright remnants were viewed with both moderate and high resolution instruments (IPC with 1' resolution and HRI with 4" resolution). Some IPC images of nearby remnants have been separated into 2 energy bands, 0.2-0.6 keV and 0.6-4.5 keV; whereas most images cover the band 0.2-4.5 keV. The catalog consists of 72 images of the 44 remnants.

These images will be published in the form illustrated here. Contour levels are spaced geometrically as indicated below the figures and show the faintest observable features. The pictures are more linear and generally show only the brighter regions. Images are available now, however, in FITS format, on magnetic tape and may be obtained by writing to the author.

The x-ray morphology may be used to classify remnants. There are:

1) shell-like SNR with definite x-ray limb brightening.

2) filled-center SNR, brightest at the center with little or no emission from the limb, x-ray spectra are suspected to be thermal, radio images are shell-like.

3) SNR with internal neutron star or bright synchrotron nebula indicating the presence of a hidden pulsar. Other data sometimes aid in this classification; e.g. a hard continuum x-ray spectrum or a center-bright radio morphology.

4) SNR dominated by a bright central source, probably an accretion-powered binary.

5) SNR with irregular morphology. None of the above categories apply, or data are too crude to determine the morphology.

The 44 remnants are listed here with a <u>preliminary</u> determination of the brightness as observed with the Einstein IPC.

Without the Einstein Observatory, these images of SNR would not exist. The observatory and imaging detectors were the result of the labors of R. Giacconi, H. Tananbaum, E. Schreier, L. Van Speybroeck, S. Murray, J.P. Henry, P. Gorenstein, F.R. Harnden, Jr.,and D. Fabricant. Thanks also to J. Brody, M. O'Shaughnessy, and L. Whitton who assisted in the preparation of material for this catalog.

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SNR Included in Catalog

	Remnant	Common Name	IPC Rate (c/s)	Type	Comments
1	4.5+6.8	Kepler	7.3±0.4	shell	SN 1604
2	6.4-0.1	W 28	3.2±0.4	full	
3	11.2-0.3	-	1.00±0.1	shell	
4	21.5-0.9	-	0.49±.05	synchrotron	
5	27.4+0.0	Kes 73	1.07±0.1	central source	
5A		1E1838-049	-	-	not resolved
6	29.7-0.2	Kes 75	0.22±.03	synchrotron	
7	31.9+0.0	3C 391	0.24±.03	irregular	
8	33.7+0.0	Kes 79	0.44±.05	irregular	
9	34.6-0.5	W 44	3.3±0.3	full	
10	39.2-0.3	3C 396	.06±.01	irregular	
11	39.7-2.0	W 50	1.6 ave.	central source	
11A		SS433	1.2 ave.	-	variable
12	41.1-0.3	3C 397	0.75±0.1	irregular	
13	43.3-0.2	W 49B	0.67±.06	full	
14	49.2-0.7	W 51	0.9	irregular	
15	53.6-2.2	3C 400.2	0.80±0.1	full	
16	65.3+5.7	GKP	-	-	incomplete data
17	68.8+2.6	CTB 80	0.17±.03	central source	
17A		1E1951+327	0.14±.01		
18	74.3-8.5	Cyg Loop	620±40	shell	
19	74.9+1.2	CTB 87	.040±.01	synchrotron	
20	78.2+2.1	W 66	>0.6	-	incomplete data
21	82.2+5.3	W 63	0.3	irregular	
22	109.2-1.0	CTB 109	5.2±0.4	central source	
22A		1E2259+586	1.1±0.1	-	7s period
23	111.7-2.1	Cas A	61±2	shell	
24	119.5+9.8	CTA 1	0.9	full	
25	120.1+1.4	Tycho	22.3±1	shell	SN 1572
26	130.7+3.1	3C 58	0.35±.04	synchrotron	
27	132.7+1.3	HB 3	2.6	irregular	
28	160.4+2.8	HB 9		-	incomplete data
29	184.6-5.8	Crab	684	synchrotron	SN 1054
29A		PSR 0531+21	-	-	"age" 1240 yr
30	189.0+3.0	IC 443	12.8	irregular	
31	260.4-3.4	Pup A	230	shell	
32	263.8-1.7	Vela SNR	490	irregular	
32A	263.5-2.7	PSR 0833-45	2.1	-	"age" 13000 yr
33	290.1-0.8	MSH 11-61A	0.47±0.1	full	
34	291.0-0.1	MSH 11-62	0.22±.05	synchrotron	
35	292.0+1.8	MSH 11-54	9.1±1.0	irregular	
36	296.1-0.7	-	3.1	shell	
37	296.5+10.0	PKS 1209-52	2.6	shell	
38	315.4-2.3	RCW 86	8.5±1.0	shell	
39	320.3-1.2	MSH 15-52	2.40±0.2	synchrotron	
39A		PSR 1509-58	0.30±.04		"age" 1550 yr
40	326.3-1.8	MSH 15-56	1.0	irregular	
41	327.1-1.1	-	.085±.02	irregular	
42	327.4+0.4	Kes 27	0.40±0.1	full	
43	327.6+14.5	SNR 1006	11.1±1.0	shell	
44	332.4-0.4	RCW 103	9.3±1.0	shell	

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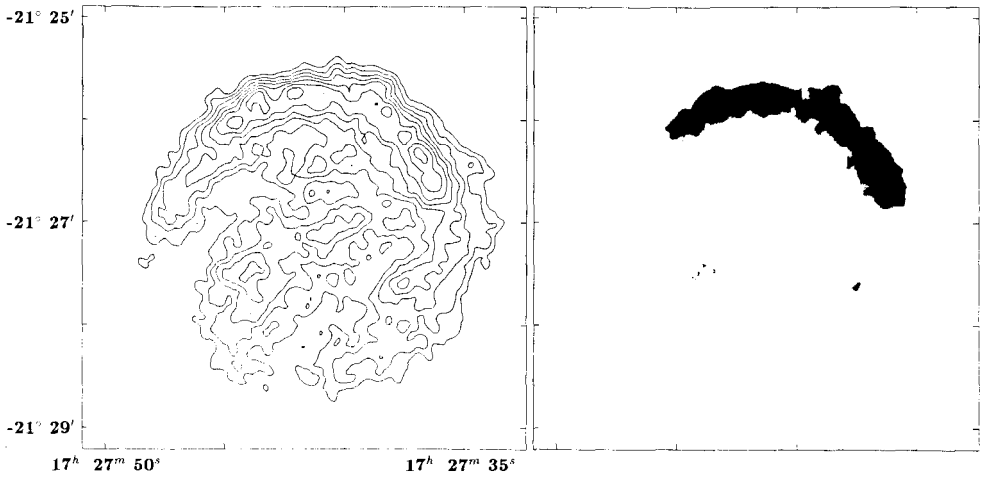
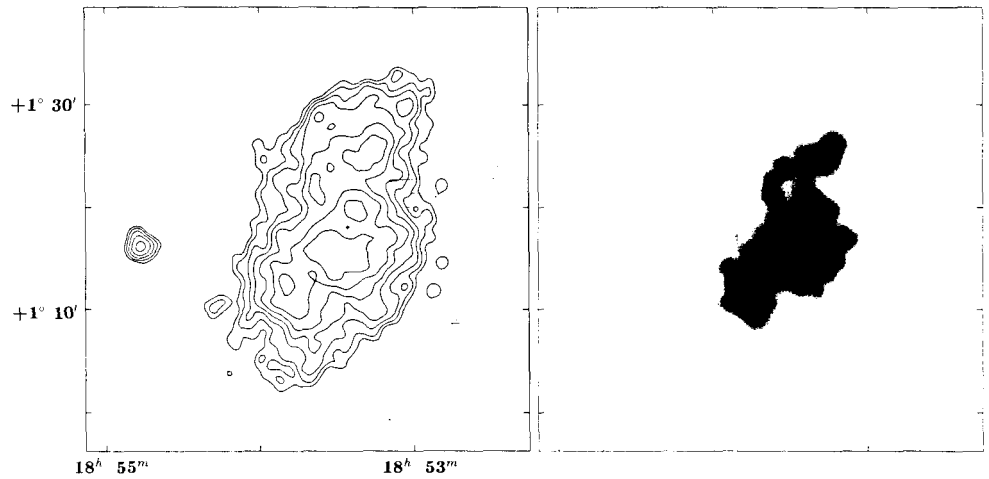
4.5+6.8 Kepler's SN



HRI, contour intervals are a factor of 1.3 in brightness.

34.6-0.5 W 44



IPC, contour intervals are a factor of 1.4 in brightness.

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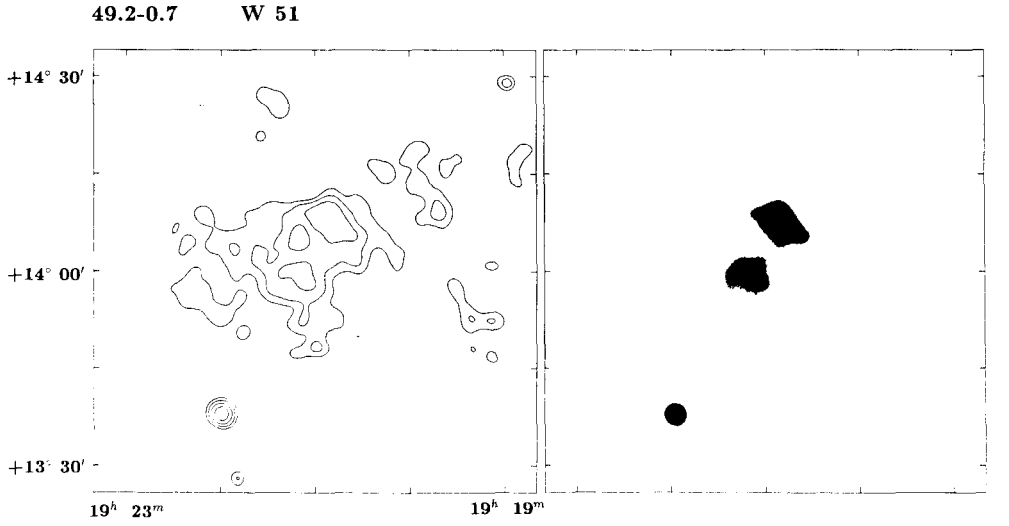
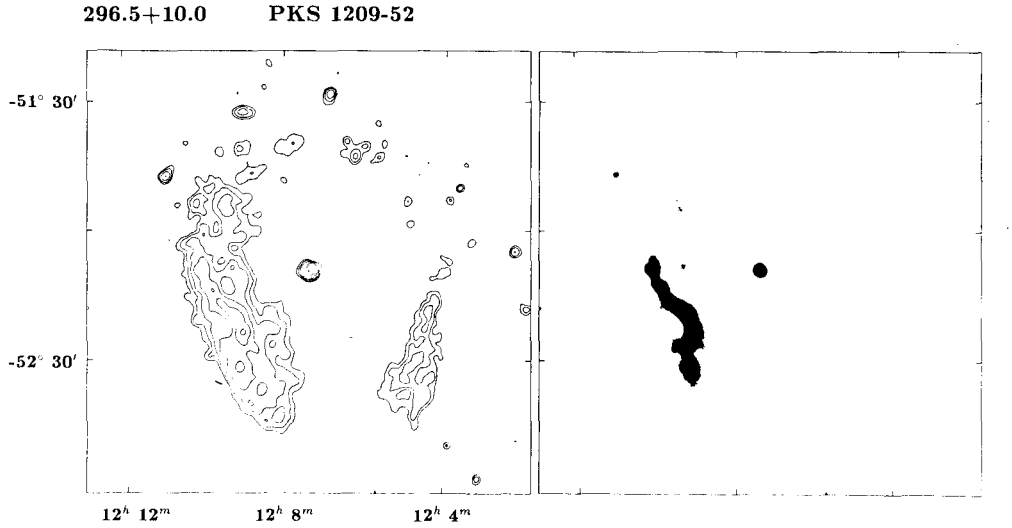


IPC, contour intervals are a factor of 1.5 in brightness.



IPC, contour intervals are a factor of 1.5 in brightness.

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