Summary of the first COMPTEL Source Catalogue

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INTRODUCTION

The imaging Compton telescope COMPTEL aboard NASA's Compton Gamma-Ray Observatory has opened the MeV gamma-ray band as a new window to astronomy. COMPTEL provided the first complete all-sky survey in the energy range 0.75 to 30 MeV. The catalogue, presented here, is largely restricted to published results from the first five years of the mission (up to Phase IV / Cycle-5). In a few cases, more recent results have been added.

The catalogue contains firm as well as marginal detections of continuum and line emitting sources and presents upper limits for various types of objects. The numbers of the most significant detections are 32 for steady sources and 31 for gamma-ray bursters. Among the continuum sources, detected so far, are spin-down pulsars, stellar black hole candidates, supernova remnants, interstellar clouds, nuclei of active galaxies, gamma-ray bursters, and the Sun during solar flares. Line detections have been made in the light of the 1.809 MeV ^{26}Al line, the 1.157 MeV ^{44}Ti line, the 847 and 1238 keV ^{56}Co lines, and the neutron capture line at 2.223 MeV. For the identification of galactic sources, a modelling of the diffuse galactic emission is essential. Such a modelling at this time does not yet exist at the reqired degree of accuracy. Therefore, a second COMPTEL source catalogue will be produced after a detailed and accurate modelling of the diffuse interstellar emission has become possible.

Here, only a summary of the First COMPTEL Source Catalogue is given. The complete catalogue will appear in the Astronomy and Astrophysics Supplement Series [1].

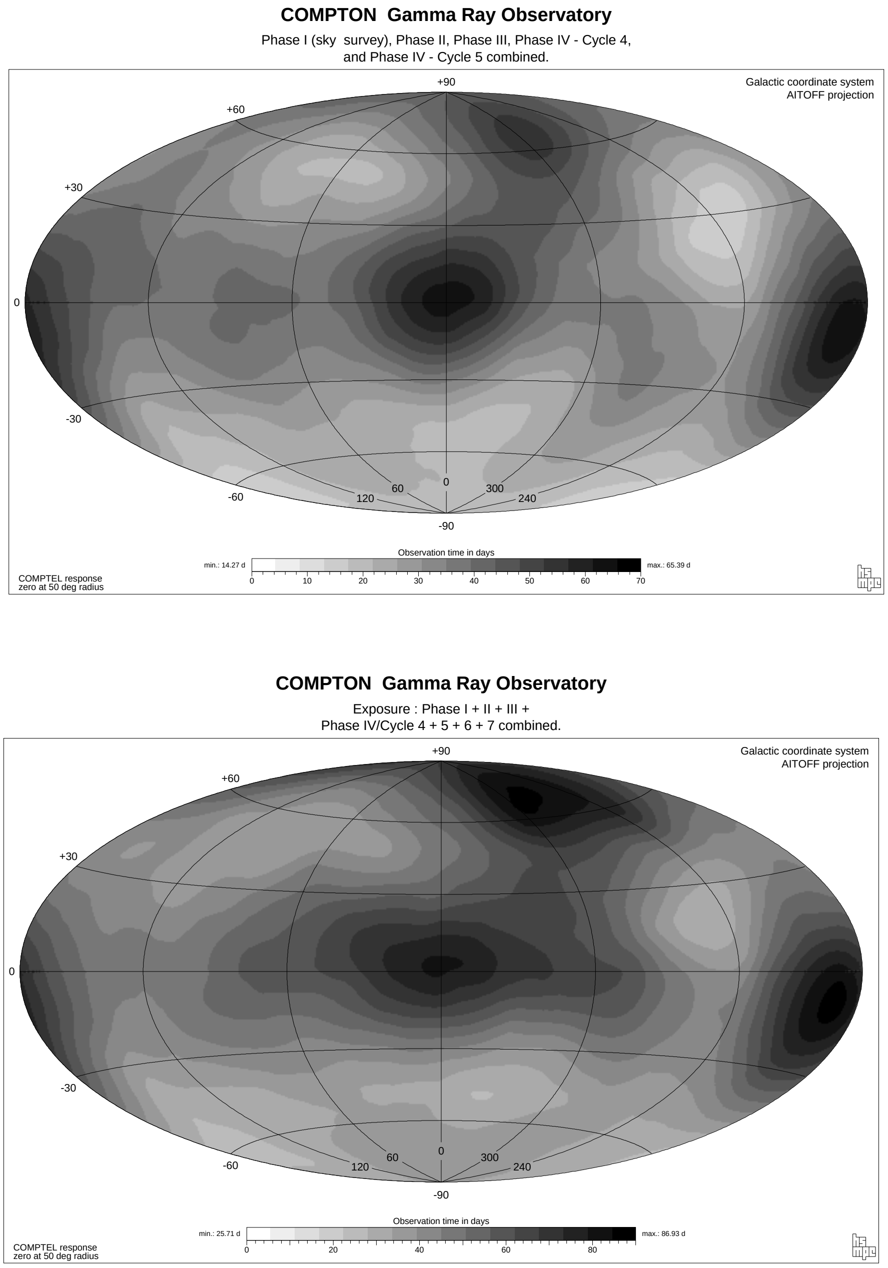

FIGURE 1. COMPTEL Exposure Maps. *Top:* Phase I to Phase IV / Cycle-5. *Bottom:* Phase I to Phase IV /Cycle-7.

OBSERVATIONS AND EXPOSURES

The effective COMPTEL exposure of the entire sky from the sum of all observations from the beginning of the mission to Phase IV /Cycle-5 is presented in Fig. 1 (top). For illustration, the improvement in exposure up to Phase IV / Cycle-7 is shown in Fig. 1 (bottom), as well. The deepest exposures were obtained in the Galactic Center and anticenter region, where effective observation times up to $6 \cdot 10^6$ (about 70 days) have been obtained.

COMPTEL SENSITIVITY

In its telescope mode COMPTEL has an unprecedented sensitivity. Within a 2-week observation period it can detect sources, which are about 10-times weaker than the Crab. By adding up all data from a certain source that were obtained over the entire duration of the mission, higher sensitivities can be otained. Table 1 summarizes the achieved point-source sensitivities for a 2-week exposure in Phase I of the mission ($t_{eff} \sim 3.5 \cdot 10^5$ sec), and for the ideal cases, when all data from a certain source in the Galactic Center or anticenter (where the exposure is highest) are added from either Phase I to III ($t_{eff} \sim 2.5 \cdot 10^6$ sec) or Phase I to IV /Cycle-5 ($t_{eff} \sim 6 \cdot 10^6$ sec).

From this table rough upper limits can be derived for those objects, which are not contained in the catalogue by deriving the effective exposure from Figure 1.

TABLE 1. From this table rough upper limits can be derived for those objects, which are not contained in the source catalogue, by deriving the effective exposure from Fig. 1.

	3σ Flux Limits [10^{-5} photons cm^{-2} sec^{-1}]		
$E_\gamma [MeV]$	2 weeks in Phase 1	Phase 1+2+3	Phase 1+2+3+4 (Cycle-5)
0.75 – 1	20.1	7.4	3.7
1 – 3	16.8	5.5	3.8
3 – 10	7.3	2.8	1.7
10 – 30	2.8	1.0	0.8
1.157	6.2	2.0	1.6
1.809	6.6	2.2	1.6

RESULTS

Table 2 summarizes the most significant source detections ($\geq 3\sigma$) from the main source catalogue paper [1], and Fig. 2 gives an all-sky view of these sources. Six of the listed sources extend over larger areas. Their extent may actually be due to a larger number of - so far - unresolved point sources (see especially Cygnus region in 1.809 MeV [2], GRO J 1823-12 [3], and HVC complex C [3]).

TABLE 2. Summary of Most Significant COMPTEL Source Detections.

Type of Source	**No. of Sources**	**Comments**
Spin-Down Pulsars:	3	Crab, Vela, PSR B1509-58.
Stellar Black Hole Candidates:	2	Cyg X-1, Nova Persei 1992 (GRO J0422+32).
Supernova Remnants: (Continuum Emission)	1	Crab nebula.
Active Galactic Nuclei:	10	CTA 102, 3C 454.3, PKS 0528+135, GRO J0516-609, PKS 0208-512, 3C 273, PKS 1222+216,3C 279, Cen A, PKS 1622-297.
Unidentified Sources:		
• $\lvert b \rvert < 10°$	4	GRO J1823-12, GRO J2228+61 (2CG 106+1.5), GRO J0241+6119 (2CG 135+01), Carina/Vela region (extended).
• $\lvert b \rvert > 10°$	5	GRO J1753+57 (extended), GRO J1040+48, GRO J1214+06, HVC complexes M and A area (extended), HVC complex C (extended).
Gamma-Ray Line Sources:		
• 1.809 MeV (^{26}Al)	3	Cygnus region (extended), Vela region (extended, may include RX J0852-4621), Carina region.
• 1.157 MeV (^{44}Ti)	2	Cas A, RX J0852-4621 (GRO J0852-4642).
• 0847 and 1.238 MeV (^{56}Co)	1	SN 1991T.
• 1.223 MeV (n-capture)	1	GRO J0317-853.
Gamma-Ray Burst Sources: (within COMPTEL field-of- up to Phase IV/Cycle-5)	31	Location error radii vary from 0.34° to 2.79° (mean error radius: view 1.13°).

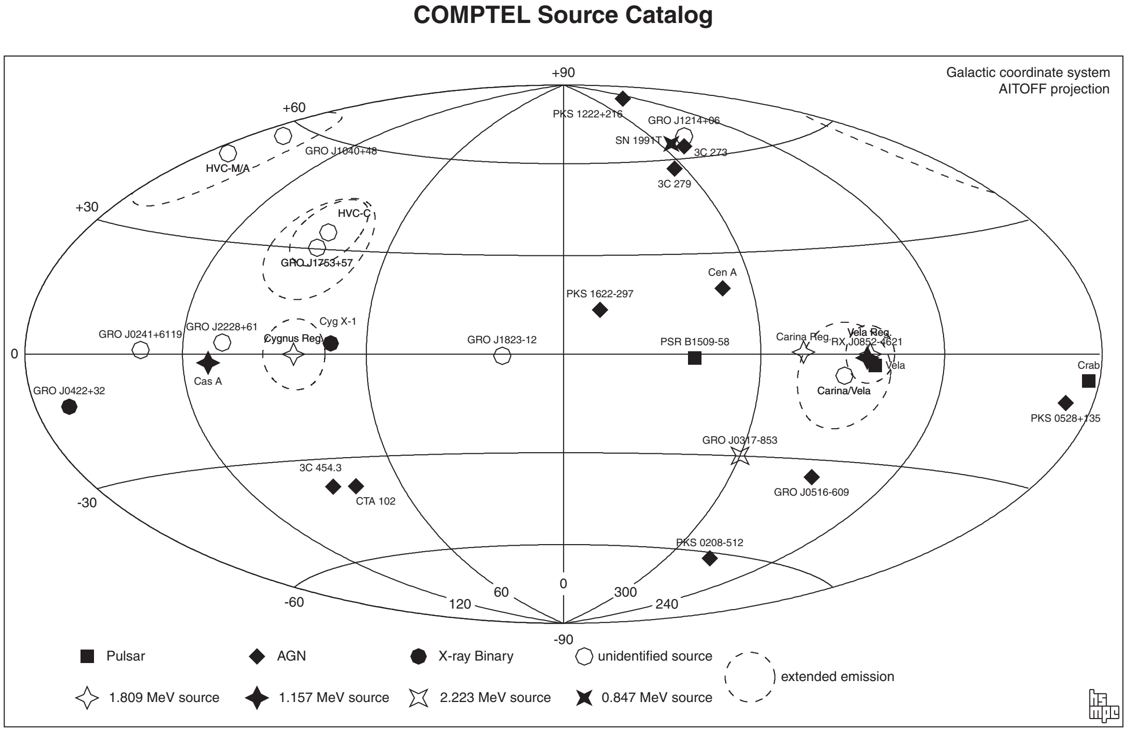

FIGURE 2. All-Sky View of the COMPTEL Source Catalogue.

ACKNOWLEDGEMENT

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