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The needle in the haystack: where to look for more isolated cooling neutron stars *(Corrigendum)*

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Recently, we discovered a bug in our population synthesis (PS) code presented in A&A 2008, 482, 617. This bug concerns the application of the improved ISM models to calculate the absorbed X-ray flux. The code erroneously did not cover the whole Galactic coordinate (l, b) range of the ISM-models to obtain the absorbing column density $N(H)$. Instead, only a small region ($\triangle l \approx 7$ deg, $\triangle b \approx 7$ deg) around the Galactic Center was used, which led to a significant overestimation of the absorption translating into an underestimation of the predicted neutron star number.

While all our main conclusions remain valid we report in the following on some details regarding the corrected results.

1. Comparison of log N-log S distributions for different model modifications

The log N-log S curves in Figs. 3 and 4 of the original paper remain unchanged. The log N-log S curves for the new analytical as well as for the Hakkila ISM model in Fig. 5 of the original paper are updated in Fig. 1. The corrected curves for both ISM models are now situated ≈0.3 dex above the observational points. The differences between the Hakkila ISM and the improved ISM analytical model are smaller than those obtained by the original PS-code. However, as before, the application of the Hakkila ISM model results in lower N for high count rates than obtained by using the analytical ISM model, and in higher N for low count rates. Comparison of our new results with observations of bright, cooling NSs indicates that the model overpredicts the number of NSs by roughly a factor of two for both ISM models. The possible reasons for this discrepancy are an inadequate treatment of the NS birth rate or of their thermal evolution, or yet other, not in this paper investigated properties like atmospheres, magnetic fields, or statistical fluctuations. Birth rates of neutron stars are highly uncertain, especially at larger distances (see, e.g., the recent discussions by Keane & Kramer 2008; Ofek 2009). However, since probably nearly all the observed XTINSs originate from the Gould Belt we have to discuss the *local* birth rate in the frame of the differences between our PS model predictions and the observational measurements. As discussed in the paper (Sect. 2.1), we adopted a birth rate of 27 Myr^{-1} up to a distance of 500 pc (Grenier 2000; Tammann et al. 1994) and of 270 Myr^{-1} for the whole distance range from 0 to 3000 pc (Tammann et al. 1994). The supernova rate ranges from 17 Myr^{-1} to 27 Myr^{-1} in the entire Gould Belt (Grenier 2004).Only 75% to 87% of

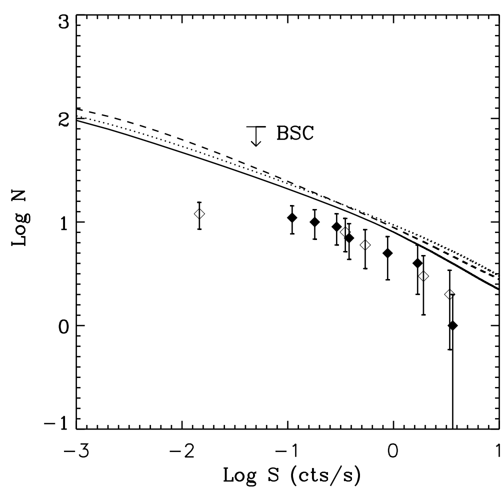

Fig. 1. Log N-log S for different X-ray absorbing ISM models. All curves are plotted for the new initial spatial distribution, the old mass spectrum and new ISM element abundances. Solid curve: old, simple analytical ISM model as, e.g., in Paper III. Dotted curve: new improved analytical ISM model (corrected); dashed curve: Hakkila ISM model (corrected).

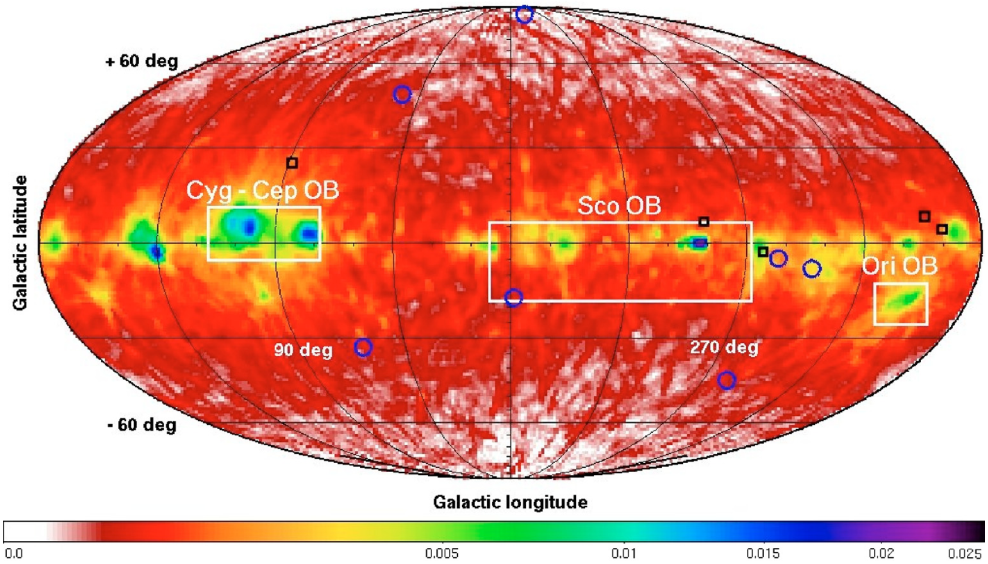

Fig. 2. Corrected version of Fig. 6, showing the expected number density of isolated neutron stars with thermal X-ray emission in units of numbers per square degree. The Galactic map is in Mollweide projection. Only sources with ROSAT PSPC count rates larger than 0.05 cts s^{-1} are considered. Marked in blue are the positions of the Magnificent Seven and in black the positions of close young radio pulsars with detected thermal X-ray emission.

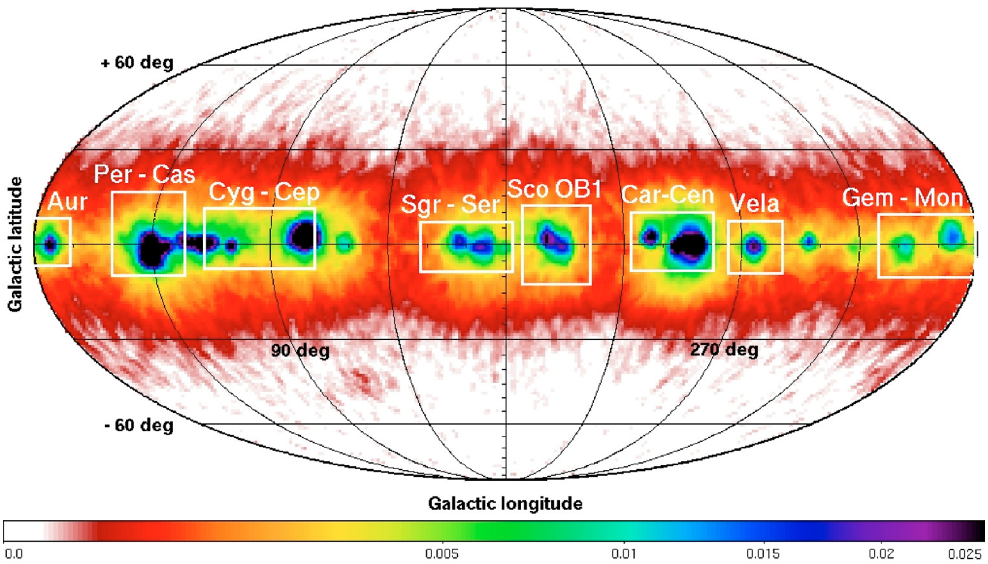

Fig. 3. Corrected version of Fig. 7. Here only faint sources with ROSAT PSPC count rates between 0.001 cts s^{-1} and 0.01 cts s^{-1} are considered.

the core-collapse supernova produce neutron stars (Heger et al. 2003). Thus, the birth rate in the Gould Belt we chose can be overestimated. However, a factor of two in the *local* birth rate uncertainy seems to be unlikely.

As mentioned in the original paper, the main conclusions about different sets of cooling curves presented in Paper III do not change. The chosen set of cooling curves in this paper actually represents the best choice of the set from Paper III. All other cooling curves from Paper III would result in an even higher log N. It is beyond the scope of this corrigendum to identify a new cooling curve set that could lead to a log N-log S curve in better agreement with observational points.

We further note the possible effect of statistical fluctuations on the uncertainty of the observed log N-log S curve, since the overall number of (young enough) neutron stars in the Gould Belt is small. We will evaluate this effect in more detail in a future paper.

2. Sky maps

For completeness we show in Figs. 2 and 3 the corrected versions of Figs. 6 and 7 from the original paper. The general picture remains the same, but on average more NSs are expected in accordance to the log N-log S curve. For bright sources, a subgroup of Sco OB2, Lower Centaurus Crux (de Zeeuw et al. 1999), is predicted to have more observable NSs compared to other Sco OB groups, which was not visible in the map obtained with the original version of the PS code.

3. Age and distance distributions

Age and distance diagrams obtained with the corrected PS-code show the same main features as those obtained with the old code except that the NS numbers of the analytical and Hakkila ISM model (the last black and diagonal-striped bars in Figs. 8 and 9 of the original paper) are larger than before, as is expected from the log N-log S curves.

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