ORIGIN OF A DIFFUSE GALACTIC EMISSION AT 511 KEV

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Recent results of SMM on the galactic 511 keV annihilation radiation (1) exhibit a constant flux during 4-5 years, in total disagreement with post 1980 balloon observations. However, all these results are compatible if one admits the existence of a variable point source near the Galactic Center of $F_P \sim 10^{-3}$ ph $cm^{-2}s^{-1}$ and a diffuse interstellar source of positrons: $F_D \sim 1.5$-$1.8\ 10^{-3}$ ph $cm^{-2}s^{-1}rad^{-1}$. Evaluations of ^{26}Al and ^{56}Co decays contributions have been given last year (2) and that of ^{44}Ti decays more recently (3). We have studied the nature of the sources of the main e^+ - emitting radioisotopes - SN and novae - and their galactic distributions using the observational data at 511 keV and at 1809 keV, the galactic angular distributions considered by Leising and Clayton (4) and the nucleosynthesis of the models of novae and SN of Woosley and his collaborators (5). Because there are two sets of data, the e^+-flux, for the central radian, produced via ^{26}Al decays can be separated from the flux produced via non ^{26}Al decays :

$$(1)\quad F_{Al} = 1.33\ \sigma_{Al\odot SN} + 2.6\ \sigma_{Al\odot n} = 4\ 10^{-4} e^+\ cm^{-2}s^{-1}rad^{-1}$$

$$(2)\quad F_{non\ Al} = 1.33\ \sigma_{non\ Al\odot SN} + 2.6\ \sigma_{non\ Al\odot n} = 19\ 10^{-4} e^+\ cm^{-2}s^{-1}rad^{-1}$$

The right hand side of Eq.(1): $4\ 10^{-4} e^+\ cm^{-2}s^{-1}rad^{-1}$ is deduced from the observed ^{26}Al line: $4.8\ 10^{-4}\ \gamma\ cm^{-2}s^{-1}rad^{-1}$ while the right hand side of Eq.(2) corresponds to the observed annihilation line with a "Ps-fraction" $f = 0.9$ (the annihilation is supposed to occur in molecular hydrogen). It becomes 11 or 3.5 $10^{-4} e^+\ cm^{-2}s^{-1}$-$rad^{-1}$ if respectively $f \sim 0.65$ or $f \sim 0$ (annihilation in dust grains). The value of f deduced from UNH's observations is $f \sim 0.7$;

- $\sigma_{Al\odot SN}$ is the local rate of e^+ ejected by SN, per unit area, and idem for others - see Table 1;

Table 1

		^{26}Al	^{56}Ni	^{44}Ti	^{22}Na
$\sigma_{\odot}$ 10^{-4} e^{+} cm^{-2} s^{-1}	novae	1.4 $a_1 t_1$			1.8 $b_1 t_1$
	SN I		7.5 $\varepsilon_1 y_1$	0.75 z_1 0.75 y_1	
	SN II	1.4 x_1		0.75 x_1	

- $\varepsilon = 10^{-2}\varepsilon_1$ is the escape fraction of e^+ from SN I via ^{56}Co decays;
- novae eject (a_1 10^{-7} $M_{\odot}$) of ^{26}Al and (b_1 10^{-7} $M_{\odot}$) of ^{22}Na at a local rate of t_1 10^{-8} pc^{-2} yr^{-1} - outbursts on a O-Ne-Mg WD -;
- there are x_1 10^{-11} pc^{-2} yr^{-1} SN II explosions of over 15 $M_{\odot}$ stars, y_1 10^{-11} pc^{-2} yr^{-1} standard SN I (SN Ia) and z_1 10^{-13} pc^{-2} yr^{-1}, Peculiar SN I-Helium dwarf detonating SN I that experience explosive helium burning (5);
- we have considered many working hypothesis (6) for the relative frequencies and the angular distributions of the various types of SN and novae.

In any case, it is possible to explain the diffuse 511 keV and 1809 keV lines with the present models of nucleosynthesis for SN and novae. The contributions to the e^+ background from Al, Co, Ti, Na decays depend of the values of the diffuse flux, the values of the Ps fraction f, the nature of the SN distributions, the rate of occurence of the Peculiar SN I. In most cases, ^{56}Co decays are the main contributor to the diffuse e^+-flux. But ^{44}Ti decays become the main contributor if a part of SN Ia and the Peculiar SN I have a nova type distribution and if the rate of these Peculiar SN I leads to the solar abundance of ^{44}Ca produced during the last 10^6 years. Moreover, if one assumes that SN Ib - which seem to be correlated with regions of recent star formation - have a CO distribution, we can reconcile the whole observational results on the 511 keV flux. Future observations such as SIGMA and GRO can have strong implications on the nucleosynthesis models of novae and SN and on galactic distributions and relative frequencies of their progenitors : in particular Wolf-Rayet but also all sorts of helium star cataclysmics.

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