Aluminium-26 from massive binary stars

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Aluminium-26 is a short-lived radionuclide with a half-life of 0.72 Myr, which is observed today in the Milky Way Galaxy via γ-ray spectroscopy and is inferred to have been present in the early Solar System via analysis of meteorites. The main contributors to the cosmic abundance of ^{26}Al are considered to be massive stars, and the yields of ^{26}Al from single, massive stars, both the stellar winds and the supernova explosions, are widely available in the literature. Massive stars, however, are often found in binary systems, and the effect of binary interactions on the ^{26}Al yields have not been investigated since Braun & Langer (1995)[1]. We present our work aimed to fill this gap. We have used the MESA stellar evolution code to compute massive ($10\,M_\odot \leq M \leq 80\,M_\odot$), non-rotating, single and binary stars of solar metallicity (Z=0.014). From these simulations we have computed the wind yields for the single stars and for the binary systems where mass transfer plays a major role. We found that, depending on the initial mass of the primary star, in a binary system the ^{26}Al yield can either increase or decrease. For binary systems with primary masses up to $\sim$35-40 $M_\odot$, the yield can increase by up to two orders of magnitude, while above $\sim 45\,M_\odot$ the yield becomes similar to the single star yield or even decreases. Our preliminary results show that the effect of winds in binary systems on the total abundance of ^{26}Al produced by a stellar population is still minor compared to that of the supernova explosions. On the other hand, if massive star winds are the origin of ^{26}Al in the early Solar System, our results will have significant implications on the identification of the potential stellar, or stellar population, source.

[1] Braun, H. and Langer, N., IAU Proceedings **163**, 305 (1995).