# ASTROPHYSICAL EFFECTIVE CROSS SECTIONS FOR $\gamma$-RAY LINE PRODUCTION

**E. Parizot** (1) and R. Lehoucq (2)
(1) Institut de Physique Nucléaire d'Orsay, 91406 Orsay, France, (2) Service d'Astrophysique, CEA-Saclay, 91191 Gif-sur-Yvette, France.
parizot@ipno.in2p3.fr

A $\gamma$-ray line production calculation in astrophysics depends on i) the composition and energy source spectrum of the energetic particles, ii) the propagation model, and iii) the nuclear cross sections. The main difficulty for model predictions and data interpretation comes from the fact that the spectrum of the particle which actually interact in the ISM (the *propagated spectrum*) is not the same as the source spectrum, due to energy dependent energy losses and confinement times. Here, we 'retro-propagate' the particles using a standard propagation model and provide effective cross sections to be used directly with the *source* spectrum. In other words, our effective cross sections enable anyone to calculate the $\gamma$-ray production induced by energetic particles with any spectrum and any composition, without having to take particle transport into account and calculate the propagated spectrum oneself.