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# Novel method for accessing tens-to-hundreds femtoseconds nuclear state lifetimes, examples and results

*Thursday, 23 September 2021 13:00 (30 minutes)*

I will presented a novel Monte Carlo technique based on DSAM (Doppler Shift Attenuation Method), which has been developed to determine lifetimes of excited states in the tens to-hundreds femtoseconds range in products of low-energy heavy-ion binary reactions [1]. These reaction processes are characterized by large energy dissipation, leading to complex velocity distributions which do not allow to apply standard Doppler broadened gamma-ray lineshape analysis. The technique is anticipated to be an important tool for lifetime investigations in exotic neutron-rich nuclei, produced with intense ISOL-type beams.

I will demontrate its relevance in connection with experiment, performed at GANIL with the AGATA+VAMOS+PARIS setup, to study neutron-rich O, C, N, nuclei. Excited states in this region, with known lifetimes, are used to validate the method between 20 fs to 400 fs lifetime range. Moreover extraction of the lifetimes of the second $2^+$ states in $^{16}$C and $^{20}$O, which have beenpredicted to be in the hundred-femtoseconds time range and to strongly depend on the three-body term of the nuclear interaction will be presented [2].

References
[1] M. Ciemała, et al., Eur. Phys. J. A, 57:156, (2021)
[2] M. Ciemała, et al., Phys. Rev. C 101, 021303(R),(2020)

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