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GAMMA SPECTROSCOPY OF LIGHT NEUTRON RICH NUCLEI

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The GANIL intermediate energy heavy ion beams have proved very efficient to produce and to study exotic light nuclei[1]. We report here on measurements of delayed gamma spectroscopy performed on neutron rich projectile fragments, produced with a ^{22}Ne and ^{40}Ar beam at 60MeV/nucleon reacting on a Be target. The key device for these experiments was the LISE spectrometer operated with an intermediate energy degrader foil preserving the achromatism of the line[2]. The nuclei transmitted by LISE were slowed down by aluminium foils and only those having the proper range were implanted in a foil. The decay of the implanted nuclei was observed with a thick plastic scintillator and a 174 cm^3 intrinsic Ge detector. The beam was pulsed according to the presumed half life of the searched nuclei. Gammas in coincidence with betas were recorded during beam on cycles as well as during beam off periods.

In Table 1 are given the measured half-lives and the energies and intensities of the observed gammas. The presented half-lives are a first time measurement for ^{25}F and ^{37}Si only. Compared to earlier reported values[3], our results are in agreement for ^{18}C and ^{20}N while a much lower half-life value is presently measured for ^{35}Al. The recent "second generation microscopic" half life predictions, recently proposed by A. Staudt et al.[4] gives satisfactory accordance with the measured values except for ^{35}Al. The deexcitation γ rays observed for these nuclei are reported for the first time. Most of them can be fitted into experimental levels of the daughters when available. In the case of ^{18}C for which several γ rays are observed, new ^{18}N excited levels, and a partial decay scheme are proposed. From a theoretical point of view, the β decay probabilities to individual daughter states have been calculated for ^{25}F only[5]. Thus a close collaborative interplay between experiment and theory is needed.

ISOTOPE ; HALF-LIFE (ms) Gamma Energy (keV)	Relative Intensity	ISOTOPE ; HALF-LIFE (ms) Gamma Energy (keV)	Relative Intensity
^{18}C ; $T_{1/2}$* = 95 (10)		^{20}N ; $T_{1/2}$* = 133 (19)	
115.0 (2)	70 (35)	95.3 (2)	100 (6)
471.8 (2)	13 (2)	1673.2 (4)	103 (22)
879.7 (2)	63 (5)		
1148.0 (3)	16 (4)		
1620.8 (3)	28 (5)	^{25}F ; $T_{1/2}$ = 100 (40)	
1734.7 (4)	26 (5)		
2499.3 (4)	55 (7)	1700.7 (10)	100
2614.2 (4)	100 (10)		
^{37}Si ; $T_{1/2}$ = 150 (50)		^{35}Al ; $T_{1/2}$* = 29 (6)	
862.0 (5)	100	62.4 (10)	100

Table 1

List of the energies, relative intensities and half-lives of the delayed gammas observed in the nuclei studied. An asterisk notes a second time half-life measurement. Numbers in parenthesis following any value represent the uncertainty in the last place or places.

1) J.P. Dufour et al., Z. Phys. A324 (1986) 487
2) J.P. Dufour et al., Nucl. Instrum. Meth. A248 (1986) 267
3) A.C. Mueller et al., Z. Phys. A330 (1988) 63
4) A. Staudt et al., Atomic Data and Nucl. Data Tables (in press)
5) B.H. Wildenthal et al., Phys. Rev. C28 (1983) 1343