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# **WITHDRAWN** Fast-timing mesurements in neutron-rich $^{65}$Co

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The region below $^{68}$Ni has recently attracted great attention, from both experimental and theoretical studies, due to the observation of a sub-shell closure at N=40 and Z=28. The collectivity in the region is revealed in the even-even Fe and Cr isotopes by the low energy of the first $2^+$ states and the enhanced $B(E2; 2^+ \rightarrow 0^+)$ reduced transition probabilities, which peak at 21(5) W.u. for $^{64}$Cr[1], $^{66}$Fe[2] and 22(3) W.u. for $^{68}$Fe[1]. These effects can only be reproduced by large-scale shell model calculations with the inclusion of the $\nu g_{9/2}$ and $\nu d_{5/2}$ orbitals.

Precise experimental information on the Co isotopes is important for understanding the nuclear structure in this region, with particular interest in the transition rates, as they can be interpreted as originating from a $\pi f_{7/2}^{-1}$ proton hole coupled to its even-even Ni neighbor. With this aim, a fast-timing ATD $\beta\gamma\gamma$(t) [3] experiment was performed at ISOLDE in CERN, where the $\beta$-decay chain of exotic neutron-rich Mn were measured.

In this work we report on the investigation of the low-energy structure of $^{65}$Co populated in the $\beta$-decay of $^{65}$Fe by means of $\gamma\gamma$ and fast-timing spectroscopy. Our $^{65}$Co level scheme confirms the transitions previously observed in [4] and expands it with several new gammas and levels up to ~2.5 MeV. Employing the ATD $\beta\gamma\gamma$(t) method, the half-lives and lifetime limits of some of the low-lying states have been measured for the first time. Some of the deduced transition rates are significantly lower than expected by the systematics of the region, yet this remains to be to be explained by shell model calculations. Making use of the measured half-lives, tentative spin-parities are proposed for some of the lower levels.

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