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Collectivity in neutron-rich Co and Mn isotopes going towards N = 40

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In the last decade, a large experimental an theoretical effort has been devoted to the study of the sub-shell closure N = 40 and the evolution of the magic number N = 50 for the Ni isotopic chain. Meanwhile the N = 50 78Ni excited states represent still nowadays an experimental challenge, the evolution of the sub-shell closure at N = 40, when taking away protons from the Ni core, has been thoroughly studied. In fact, it has been measured that, by removing protons from the f7/2 shell below 68Ni, the N = 40 subshell gap vanishes and a new region with large quadrupole deformation appears, as is the case of 66Fe and 64Cr [1,2]. A large theoretical effort within the shell-model framework has been done to describe this development of deformation and it has been shown that only by the inclusion of the d5/2 neutron orbital beyond N = 50 the deformation can be reproduced in this so called new island of inversion [3,4]. In this work we employed the AGATA demostrator coupled to the PRISMA spectrometer to study the low-lying excited states in the neutron-rich Co. With one proton hole respect to Ni, Co isotopes present both collective and single-particle states [5,6]. We have also studied the excited states in neutron-rich Mn isotopes (three proton holes respect to Ni). The lifetimes of the excited states in 63,65Co as well as 59,61Mn have been measured employing the Recoil-Distance-Doppler-Shift method.
The experimental B(E2) values have been compared with LSSM calculations, which lead us to draw some conclusions on the role of the d5/2 and g9/2 neutron orbitals in driving collectivity below 68Ni.

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