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New states in 32Mg and 34Si

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We have studied the spectroscopy of neutron rich nuclei in the region of N=20 with a new method, using different reactions to produce the same nucleus. A composite secondary beam formed by several nuclei in the region of the island of inversion was produced by fragmentation at GANIL with the SISSI device, at an energy close to 30 MeV/nucleon. It was transported to the VAMOS spectrometer beam line and each incident particle was identified by time of flight and energy loss. The reactions of these nuclei on a CD¬2 target were measured simultaneously: (d,d') inelastic scattering, (d,p), (d,t) and (d,3He) transfer reactions, and fragmentation reactions. The spectroscopy of 32Mg, 32,33,34Al, 33,34,35Si was studied by the deexcitation γ's measured with the EXOGAM clover array, in coincidence with the ejectile at the focal plane of VAMOS. New level schemes are proposed for these nuclei, based on γ−γ coincidences, and angular distributions are obtained for the most strongly populated transitions.
In particular, for 34Si, the angular distributions for the two most strongly populated transitions at 3.3 MeV (2+−>0+gs) and 929 keV were obtained (see Fig.1), confirming the E1 character of the latter and therefore the 3- spin/parity assignment for the state at 4.2 MeV, which was previously only indirectly attributed, through population considerations from β-decay. Furthermore the second excited 0+ state was searched for. The previous assignment obtained from in-flight excitation was ruled out by the present γ−γ coincidence studies and a new candidate is proposed at 4.0 MeV.
In the case of 32Mg, we determined the multipolarity of the 1.43 MeV transition and therefore the spin/parity of the state at 2.32 MeV for which conflicting results existed. The γ−γ data show some evidence for a new isomeric state around 3.9 MeV.
The experimental method will be explained and the results obtained for the N=20 benchmark nuclei 32Mg and 34Si will be discussed, together with their consequences on the understanding of the neutron rich nuclei in the so-called "island of inversion"region.

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