One Nucleon Transfer Reactions Around ^{68}Ni at REX-ISOLDE

N. Patronis[1], R. Raabe[1],V. Bildstein[2], T. Behrens[2], N. Bree[1], T. Faestermann[2], R. Gernhäuser[2], M. Huyse[1], Th. Kröll[2], R. Krücken[2], M. Mahgoub[2], P. Maierbeck[2], I. Stefanescu[1], J. Van De Walle[1], P. Van Duppen[1]
and the REX-ISOLDE and MINIBALL collaborations
[1]Instituut voor Kern- en Stralingsfysica, K. U. Leuven, Celestijnenlaan 200D, B-3001 Leuven, Belgium
[2]Physik- Department E12, Technische Universität München, Garching, Germany

Recently, it has been suggested that by changing the number of neutrons with respect the protons the size of shell gaps alters for several reasons [1-2]. Weakening of the spin-orbit force caused by the diffuse neutron matter [3], or the effect of tensor monopole neutron-proton interaction [4], are two possible causes for this effect. The magic numbers can be considered as the keystones for the modeling the nuclear structure. One interesting region of the nuclear chart situated around ^{68}Ni because of the closed proton shell (Z=28) and the closed neutron harmonic-oscillator sub-shell (N=40), where the $\nu 1g_{9/2}$ unique parity orbital plays a key role.

Up to know the collective properties of the neutron reach unstable isotopes of Ni, Zn and Cu at the N=40/50 mass region have been experimentally studied through the "safe" low energy Coulomb excitation [5,6], through intermediate energy Coulomb excitation [7,8] and β-decay studies [9,10]. The experimental determination of the single particle character of the ground and first excited states of the odd-Ni isotopes will shed more light to the nuclear structure of the mass region around the ^{68}Ni nuclei.

The last four decades the one-nucleon transfer reactions have been proved the workhorse for the deduction of spectroscopic information for nuclei at or near the valley of stability. The REX-ISOLDE facility at CERN provides intensive and well-defined beams of unstable nuclei at energies of 3A MeV. Furthermore, the newly built position sensitive Si detectors array of nearly 4π angular coverage combined with the Miniball detectors array, constitute a unique tool for the study of one-nucleon transfer reactions [11]. According to the above arguments, the experimental study of d(^{66}Ni,p)^{67}Ni reaction will be proposed, as a starting point for a series of experiments aiming to the study of the single particle character of the levels of the odd mass neutron reach unstable Ni isotopes. The objectives of this work are the unambiguous determination of the spin and parities of the ground and first excited states of ^{67}Ni and of the corresponding spectroscopic factors that will be compared with those from large-scale shell model calculations. In this contribution, the feasibility and sensitivity of the experiment will be presented.

[1] T. Otsuka *et al.*, Phys. Rev. Lett. **87**, 082502 (2001).
[2] D. Warner, Nature (London) **430**, 517 (2004).
[3] J. Dobaczewski *et al.*, Phys. Rev. Lett. **72**, 981 (1994).
[4] T. Otsuka *et al.*, Phys. Rev. Lett. **95**, 232502 (2005).
[5] I. Stefanescu *et al.*, Phys. Rev. Lett. **98**, 122701 (2007).
[6] J. Van De Walle *et al.*, in preparation.
[7] O. Sorlin *et al.*, Phys. Rev. Lett. **88**, 092501 (2002).
[8] O. Perru *et al.*, Phys. Rev. Lett. **96**, 232501 (2006).
[9] W. F. Mueller *et al.*, Phys. Rev. Lett. **83**, 3613 (1999).
[10] S. Franchoo *et al.*, Phys. Rev. Lett. **81**, 3100 (1998).
[11] V. Bildstein *et al.*, ISOLDE Workshop and Users meeting, CERN, Geneva, (2007).