Contribution ID: **4** Type: **not specified**

# Studies of np pairing in N=Z nuclei at ISOLDE with the ISS: the 48Cr(3He,p)50Mn reaction

*Tuesday 21 July 2020 14:56 (12 minutes)*

The question of np pairing in N=Z nuclei remains a subject of much interest in the nuclear structure community [1]. While clearly T=1 np pairing exists on an equal footing with T=1 nn and pp pairing, it is still an open question if the T=0 part of the force gives rise to collective pairing effects.

Two-nucleon transfer reactions such as (t,p) and (p,t) reactions provided a unique tool to understand pairing correlations in nuclei [2], and suggest that the transfer of an np pair from even-even to odd-odd self conjugate nuclei may stand out as the best tool to study these correlations. The (p,3He) and (3He,p) reactions appear as the best choice since the np pair can be transferred in both isospin states. Beyond 40Ca, these studies require radioactive beams and
the use of reverse kinematics techniques.

Cross-section measurements for np transfers from an even-even projectile to the lowest Jπ=0+,1+ states in the odd-odd neighbor, and specifically the ratio σ(0+)/σ(1+) itself (which minimizes systematic effects) are sensitive to the pairing collectivity in the respective channels. Recent systematic studies in N=Z sd-shell nuclei [3] showed that these are indeed key observables to quantify the interplay between T=0 and T=1 pairing [3].

First measurements with radioactive beams have been carried out at ATLAS [4] and GANIL [5], where the reactions 44Ti(3He,p)46V and 56Ni, 52Fe(3He,p)54Co,50Mn were respectively studied. The combined results provide strong evidence for an isospin-triplet superfluid phase but the anticipated collective nature in the isospin-singlet pairing remains elusive.

These reactions are well suited to be studied at HIE-ISOLDE with the Solenoidal Spectrometer ISS setup, which offers a large acceptance and excellent resolving power in terms of particle identification and effective energy resolution.
Since we are interested in L=0 (S=0, S=1) transfers, the cross-sections are forward peaked in the CM frame. Due to the reverse kinematics and typical Q-values, the forward CM protons go backwards in the Lab with energies of about 5MeV. Here we propose to complete the study of f-shell nuclei with the 48Cr(3He,p)50Mn reaction. With 48Cr located at mid-shell, simple arguments suggest that pairing collective effects are maximized and are confirmed by realistic GXPF1+DWBA calculations [5]. The anticipated yield of 48Cr, ˜106 pps on target [6], is very adequate for a successful 7 days measurement.

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**Session Classification:** New proposals

**Track Classification:** New proposals