Contribution ID: **196**   Type: **Oral presentation**

BCS description of weakly bound nuclei with a discretized continuum

Thursday, 25 June 2015 15:35 (20 minutes)

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Present developments in nuclear facilities allow to study new exotic nuclei, approaching the proton and neutron driplines for both light and medium mass regions of the Segrè Chart. Nuclei close to the dripline are weakly bound and, therefore, affected by the continuum, situations where the last nucleon or nucleons are no longer bound and can explore distances far from the rest of the nucleus.

The effects of the continuum have been traditionally explored for light nuclei where the proximity of the driplines provides a rich variety of weakly bound nuclei and experimental data. In the medium mass region, several attempts for generalizing mean field approaches have been proposed with different results [1,2]. Regarding the Bardeen-Cooper-Schrieffer (BCS) approximation, the single particle continuum is first discretized and then treated normally splitting resonant and background contributions or including a continuum single particle level density [2].

In this contribution we explore the possibility of treating background and resonant parts of the continuum on the same footage. In order to do so, an average constant pairing interaction G cannot be used. General BCS equations are solved for a pairing strength that depends on the single particle wavefunctions of the neutrons forming the Cooper pair. This non-constant G is obtained integrating a residual delta interaction between the different pairs.

This procedure is applied to neutron rich oxygen isotopes. We compare the calculated experimental binding energies and two neutron separation energies with the available experimental data. We also study the spectroscopic factors for two neutron transfer reactions in this isotopic chain. The impact of the different choices for discretizing and including the continuum on these observables is discussed.

[1] PRC 53, 2809 (1996)
[2] NPA 879, 14 (2012)

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Session Classification: Reactions and Structure - Unstable Nuclei

Track Classification: Reactions and Structure - Unstable Nuclei