Searching for proton-neutron pairing in ^{48}Cr

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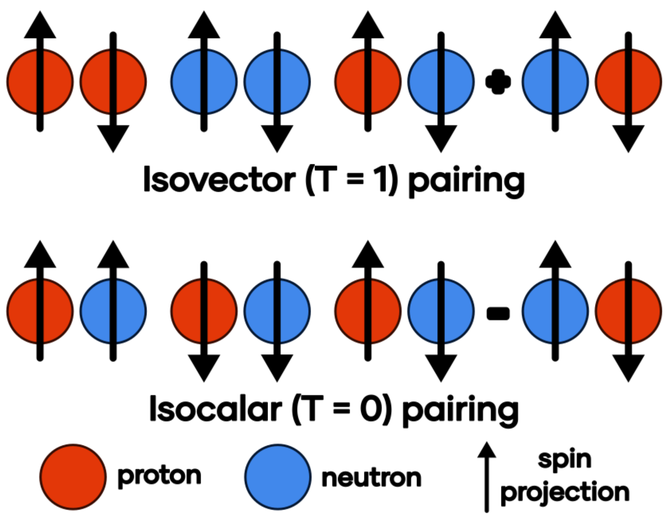
Proton-neutron pairing



- Identical particle pairing is always isovector (T = 1), whereas proton-neutron pairing can either be isovector (T = 1) or isoscalar (T = 0)

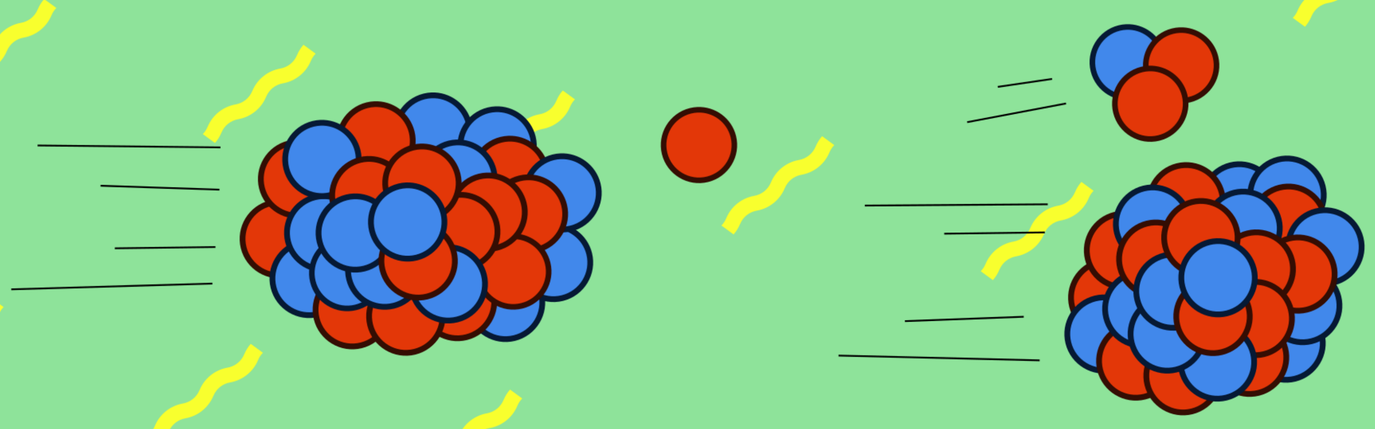
- Pairing is a collective nuclear structure effect that increases binding energy by coupling nucleons in pairs

- Proton-neutron pairing favored in N = Z nuclei because of wave-functions overlaps

- The presence of a low-lying 0+ (1+) state at low energy is a signature of the isovector (isoscalar) pairing

- Deuton bound in isoscalar channel (J = 1, T = 0)

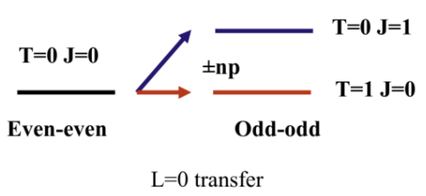
$^{48}_{24}Cr(p,^{3}_{2}He)^{46}_{23}V$



Transfer reactions

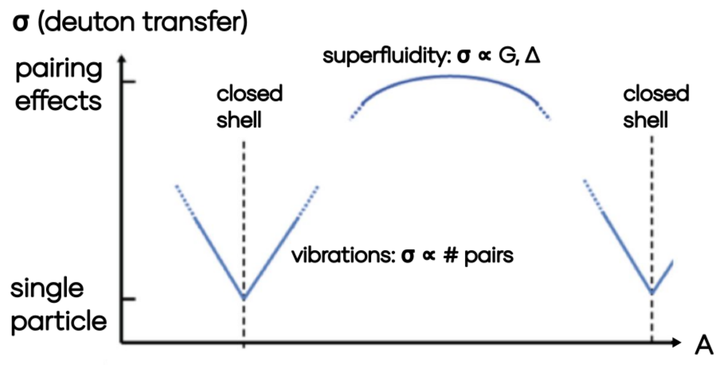
- Reaction $^{48}_{24}Cr(p,^{3}_{2}He)^{46}_{23}V$ at 30 MeV/nucleon to observe deuton transfer
- ^{48}Cr is a radioactive beam produced by fragmentation in LISE spectrometer at GANIL

Populated levels in (p,3He) reaction



- Particles and gamma detection are necessary to identify the states

Transfer cross-section enhancement

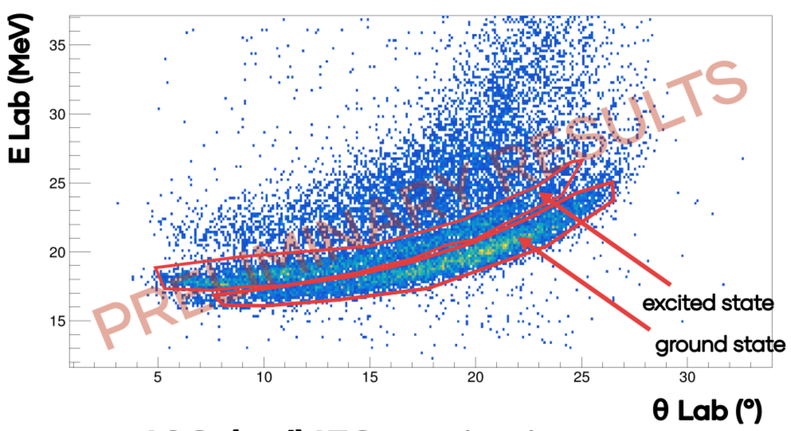


- G = pairing strength, Δ = single particle energy gap
- Physical observable: ratio of cross-sections to the isovector and isoscalar pairing states

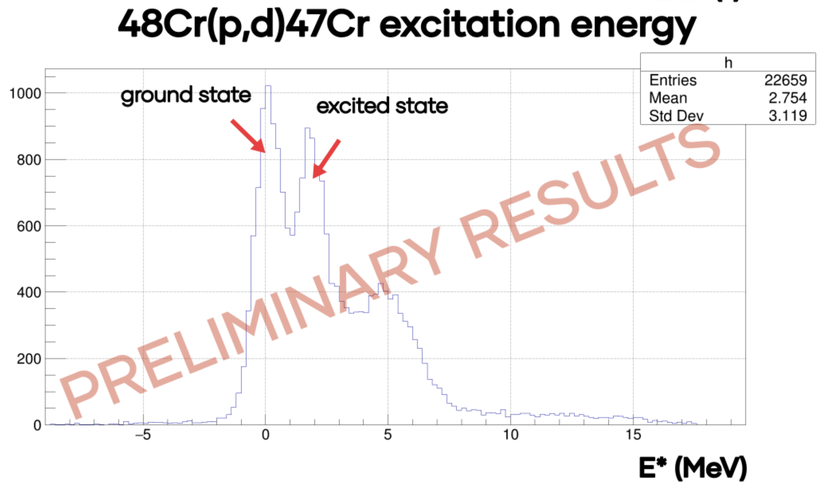
Online results

- Experiment successfully performed at GANIL in April 2023
- We analyze (p,d) online because it has similar kinematics and greater cross-section than (p,3He)

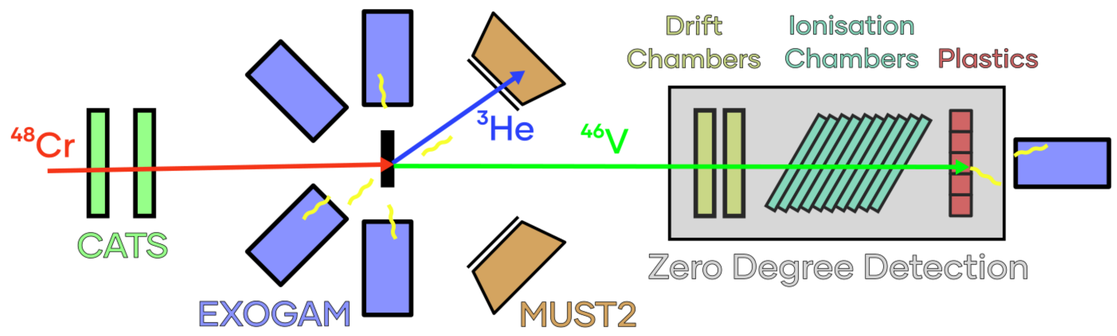
48Cr(p,d)47Cr kinematic lines

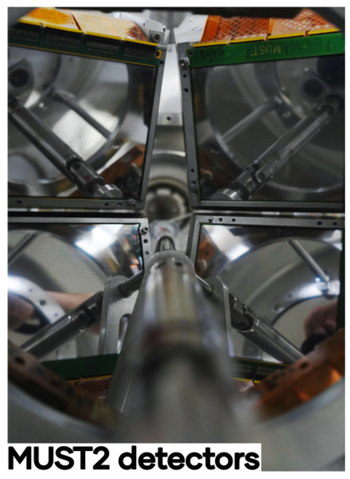


48Cr(p,d)47Cr excitation energy



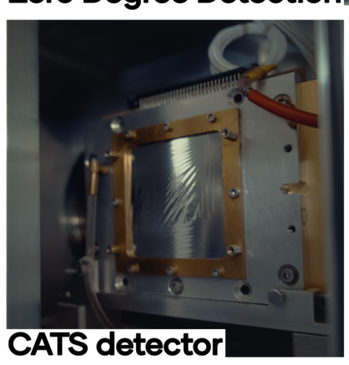
Experimental setup




MUST2 detectors


Zero Degree Detection


Targets


CATS detector


EXOGAM detectors