Pairing-vibration degrees of freedom in Ca isotopes excited by multinucleon transfer reactions

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Transfer reactions are known to be a useful tool in particle-particle correlation studies. In inclusive multinucleon transfer (MNT) measurements [1], attempts to identify pair transfer modes were based on the study of total or differential cross sections, and in neither case a selective population of specific Q-value ranges was reported. In MNT reactions of ^{40}Ca scattered on different targets with closed and semi-closed shells (^{208}Pb, ^{90}Zr and ^{96}Zr), recently studied using the LNL time-of-flight spectrometer, a selective population of a 6 MeV excitation energy region in ^{42}Ca was observed [2]. Figure shows the total kinetic energy loss (TKEL) of the two neutron pick-up channel together with theoretical predictions (Complex WKB). As can be seen, the TKEL distribution displays a well defined maximum that is shifted to high energy losses, leaving unpopulated the ground states. By looking at this final population and the known low energy spectrum of ^{42}Ca, we have attributed such energy population to states with two neutrons in the $2p_{3/2}$ orbital, i.e. to the excited 0^+ states that were interpreted as corresponding to the pair vibrational states. This is in agreement with the large scale shell model calculations [3], whose obtained strength distribution closely shows that there is a strong concentration of $(p_{3/2})^0$ strength near an ^{42}Ca excitation energy of $\sim$ 6 MeV. If these states are preferentially populated in the transfer reaction, as expected for the pair mode, this non diluted strength concentration explains the experimentally observed TKEL distributions.

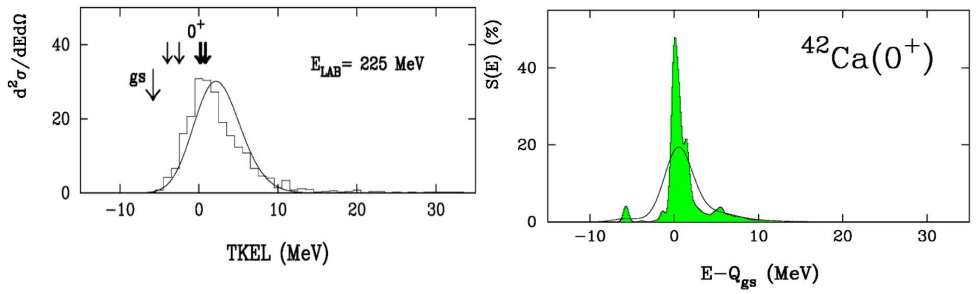

Figure 1: Left: Experimental (histograms) and theoretical (curves) TKEL distribution of the +2n channel in ^{40}Ca+^{208}Pb. Right: The strength function $S(E)$ from shell model calculations after convoluting with Gaussian of two different widths (300 keV and 1.5 MeV).

[1] L. Corradi et al., *Phys. Rev.* C **66**, 024606 (2002) and refs. therein.
[2] S. Szilner et al., Ann. Rep. of LNL; submitted to *Phys. Rev. Lett.*.
[3] E. Caurier et al., *Phys. Lett.* B, 240 (2001).