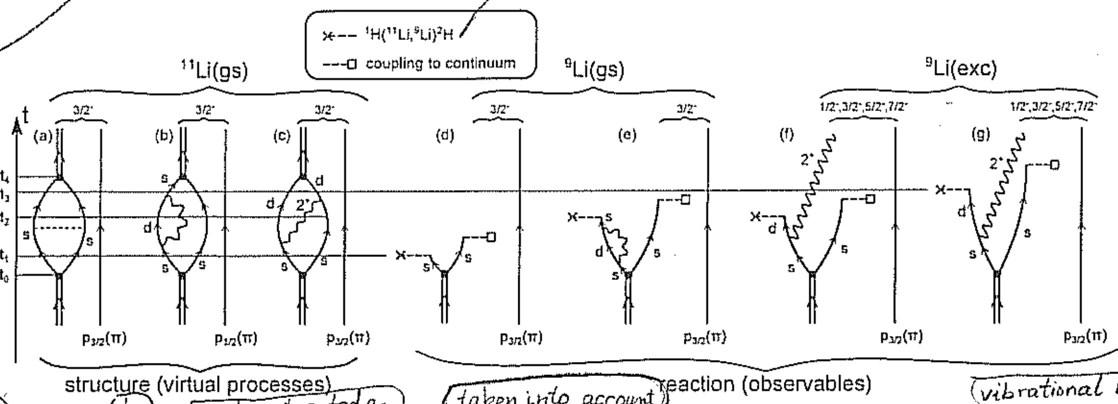
6.1.4

(observer)



nvetto

t4

(t) (t0) (, here treated as) (taken into account) (vibrational mode)

FIG. (?) Nuclear Field Theory diagrams describing the basic, lowest order processes, by which the di–neutron halo binds to the $^9_3$Li$_6$ core (**structure**), and those associated with a one–neutron pick–up process like e.g. (p,d) (**reaction**). In keeping with the fact that ^{10}Li is not bound, such a reaction populates only transiently the virtual and resonant states of ^{10}Li and eventually, after the second neutron of the pair spoliated of its dynamical glue leaves the system by going into the continuum, a state in ^{9}Li is populated. In drawing the different NFT diagrams time t is assumend to run upwards. External fields and the bare NN–interaction are assumed to act instantaneously, while the couplings to the phonon modes (wavy lines) lead to retarded (ω–dependent) effects. For simplicity, only the quadrupole ~~vibrate~~ of the ^{8}He core is considered, as well as only the virtual s– and continuum d– single–particle states are ~~considered~~. The halo Cooper pair (pair addition mode of the $N = 6$ (e.g. with closed shell system) carries angular momentum 0^+ and is represented by a double arrowed line, the odd proton (π) which occupies a $p_{3/2}$ state, represented by a single arrowed ~~being~~ a spectator. The di–neutron system binds to the core through (a) the bare interaction (horizontal dashed line) acting between the two–neutron, each represented by a single arrowed line; (b) effective mass processes associated with the quadrupole vibration of ^{8}He (wavy line) renormalizing the energy of the $s_{1/2}$ continuum state and leading to an almost bound (virtual) state ($\approx$ 0.2 MeV). (c) Induced pairing interaction associated with the quadrupole vibration of ^{8}He. (d) Intervening the process (a) at any time after t_0 and before t_4 with an external single–neutron pick–up field and processes (b) and (c) at $t_0 < t < t_1$, ~~(in particular with~~ the (^{1}H,^{2}H) field (cross followed, horizontal dashed line), leads to the ground state of ^{9}Li, in keeping with the fact that the second neutron will leave the system almost immediately, ^{10}Li not being stable. (e) Same as above but in connection with process (b) and now after the nucleon has reabsorbed the quadrupole phonon and before t_4, i.e. acting at $t_3 < t < t_4$ leads again to the population of the ^{9}Li ground state. Let us now consider the one–nucleon ~~transfer~~ processes populating the $(2 \otimes p_{1/2}(\pi))_{J^\pi}$ ($J^\pi = 1/2^-, 3/2^-, 5/2^-$and $7/2^-$) multiplet of ^{9}Li, in particular the lowest $|1/2^-; 2.69$ MeV) state. (f) ~~Same as above, that is in connection with process (b)~~, but before the phonon is reabsorbed. (g) Same as ~~above~~ (f) but in connection with process (c), ~~and acting at any time after the phonon has been emitted and before it is reabsorbed ($t_1 < t < t_2$)~~. While the single contribution associated with mass renormalization process ((b)→ (f)) and vertex corrections ((c)→ (g)) cannot be experimentally distinguished, one can estimate the relative contribution to the corresponding absolute cross section. The wavefunction of ~~ref~~ [?] (cf. also Fig. ~~??(b)~~)) predict a ratio 3/1.

pickup (by an) (These are) t_3 (t) (t_4) (t_0) (t) (t_1) (Barranco et al (2001))

6.1.3 (b) and (II)

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nvetto

The external field acts on (b) at time t_2

(f) same as (e) but in this case the external field acts on the process (c).