Calculations:

We calculate the transition energy of: F(9, 9) decaying by proton conversion into O(8,10) after the proton decayed. We need the distance between orbital layer P_L and P_R. This distance is nearly the same as the radius of He(2, 2) = d = R_0 (2*2)^(1/3) = 1.587 fm. We use: E = m|**a**|d. Seeing that the neutron will accelerate halfway and then decellerate the rest of the way we have E = m |a| d/2 + m |a| d/2. We estimate |**a**| with : E = 10^6*a* (1.587/2)*10^{-15} = 10*10^6 eV => a = 1.26*10^{16} m/s^2. We will use this value in what follows. After travelling d/2 fm: dx/(dt/dt) = 12.6 fm/s^2, dx = d/2 =12.6*10^{-15}* t^2/2 => t = SQR(1.587/12.6) = 0.1122 s. This looks realistic. After so much seconds the neutron moves at: dx/dt = integral 12.6 dt speed v = 12.6*0.1122 = 1.41 fm/s. This is much slower than the speed of light. Typical speeds are 2 SQRT (MeV/kg) (see ref. [13]).

As can be seen, the model is more predictive than just an energy level diagram. It can be seen that the energy levels of the R orbital layer does not have equal energy levels as one would be led to believe in the "random model".

We see by the classical analysis that the excited O(8,10) will emit 8 photons before becoming the stable O(8,10), $J^P = 0^+$. This is for 4 transitions. Quantum mechanically the emmited photon energies is just the difference in momentum of the 4 orbitals, so just 4 photons would be emitted, two of which having the same frequency (see the following figure):

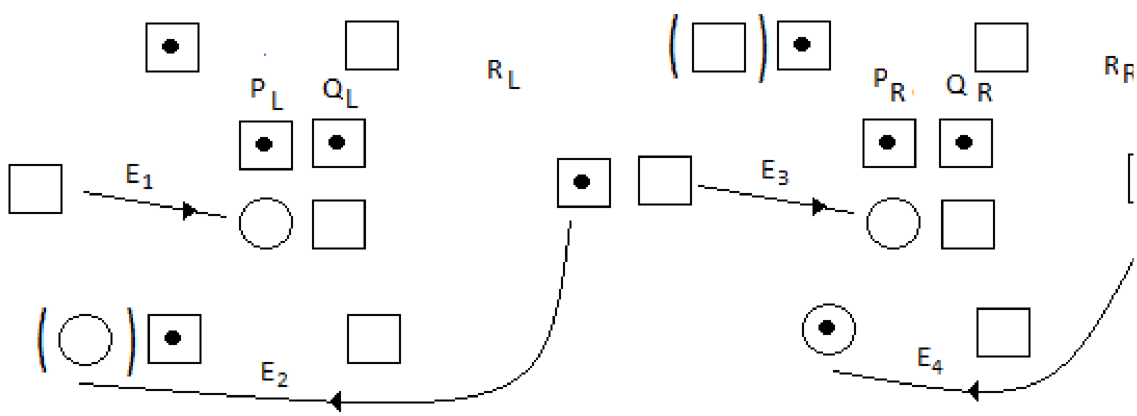

Figure 17.1

We see that all the transitions are to lower energy levels, so the reaction is exothermic.

We proceed to calculate the energy levels of transitions as indicated in the following figure (labelled by E_n). To do this we examine the model's prediction for B(5, 4):

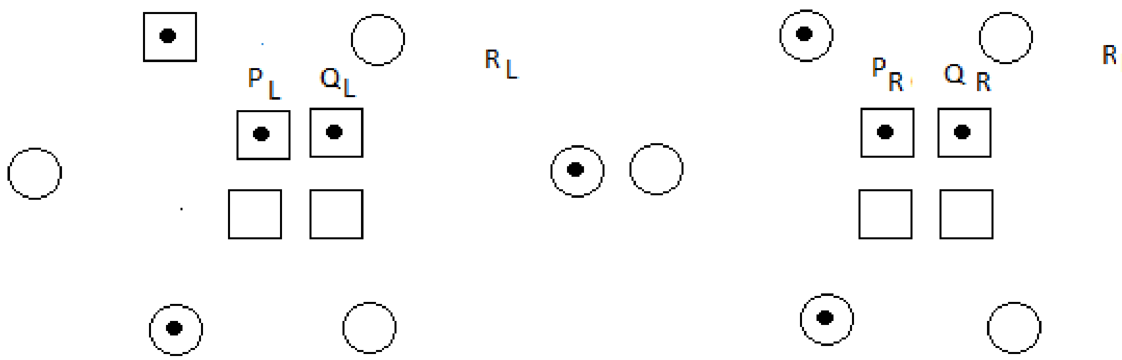

Figure 17.2

We label the energy levels by the layer they are in with an 1 or 2 for single and double distance orbitals respectively. Thus the energy level of the proton in R_L will be denoted: E_{R1}. We assume the P and Q nucleons are at the centre of the coordinate system. Then the potential energy at E_{R1}'s location (r) is:

$$U(r) = -He^{-r/r_0}*4/r, \qquad (1)$$

where r_0 = 0.7617*10^(-15) and H = 0.0627. The energy associated with the angular momentum of E_{R1} is:

$$E = mvr/t_0, \qquad (2)$$

where t_0 is the time required for one cycle.

We have the nuclear force on the proton E_{R1} as a result of the other nucleons, taken as to be at the centre of the nucleus is:

$$F = -He^{(-r/r_0)}*4/r^2. \qquad (3)$$

This must equal the centripetal force = $\gamma m_p v^2/r$. So our first formula is:

$$F = -He^{(-r/r_0)}*4/r^2 = \gamma m_p v^2/r. \qquad (4)$$

or

$$-He^{(-r/r_0)}*4/r = \gamma m_p v^2$$

Since the Orbital Angular Momentum (L) of E_{R1} must equal one times h/2pi we have our second formula:

$\gamma m_p vr = h/2pi.$ (5)

Make r the subject of (5):

$r = h/2pi*\gamma m_p*v.$ (6)

Substituting (6) into (4) and taking v to the right side we get:

$He^{-h/(2pi*\gamma m*v*r_0)}*4*2pi*\gamma m_p*v/h = \gamma m_p v^2$

$H*8pi/h = ve^{h/(2pi*\gamma m*v*r_0)}$ (7)

This gives ($h = 6.626*10^{-34}$):

$ve^{h/(2pi*\gamma m*v*r_0)} = H*8pi/h = 2.38*10^{33}.$ (8)

Iterating v, this gives:

$v = 2.38*10^{33}$ m/s

Thus ($m_p = 1,677*10^{-27}$):

$E_{R1} = m_p v^2/2 = 4.75*10^{39}$ J $= 7.560*10^{20}$ eV. (9)

This is too large by 11 orders of magnitude (< $1/m_p$). The error is left to the reader to find.

Substituting (6) into (2) we get

$E = (mvh/(2pi*\gamma m_p*v))/(2pi*r/v)$

$= (mh/(2pi*\gamma m_p))/(2pih/(2pi*\gamma m_p*v))$

$= (h/(2pi*\gamma))*\gamma m_p*v/h$

$= m_p*v/2pi$

$= 0.653*10^6$ J $= 1.108*10^{-13}$ eV
(10)

which is much too small.