

COULOMB EFFECTS IN COLD FISSION

M. Montoya (*), R. W. Hasse (**)

*Gesellschaft für Schwerionenforschung,
61 Darmstadt, Federal Republic of Germany*

and P. Koczon

*Institut für Kernphysik, Technische Hochschule Darmstadt,
61 Darmstadt, Federal Republic of Germany*

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ABSTRACT

The structures in the mass and total kinetic energy (TKE) distributions in cold fission of ^{234}U and ^{236}U are interpreted in terms of the Coulomb interaction energy (C) between fragments at the scission point. The maximal value of C (C_{max}) corresponding to the most compact scission configuration, is calculated for several mass fragmentations. It is shown that C_{max} increases, if one increases the charge asymmetry for a given primary fragmentation and Q being constant. This dependence produces oscillations with a period of approximately 5 amu of C as a function of the light fragment mass which are correlated with the observed oscillations of the maximal value of TKE. Moreover, it follows that the yields of the more asymmetric charge fragmentation of the same system are increased, that is for the more compact configuration.

RESUMEN

Se interpretan las estructuras de la distribución de masa y de energía cinética total (TKE), en la fisión fría de ^{234}U y ^{236}U , en términos de la energía de interacción coulombiana (C) en la escisión. El valor máximo de C (C_{max}) correspondiente a la configuración más compacta, es interpretada para varias fragmentaciones de masa. Se muestra que C_{max} aumenta si la asimetría de carga aumenta para una fragmentación primaria manteniendo el mismo valor de Q. Esta dependencia produce oscilaciones, con un periodo de 5 uma del valor máximo de C en función de la masa del fragmento liviano que están correlacionadas con las oscilaciones observadas en el valor máximo de TKE. Además, resulta que el rendimiento de las fragmentaciones más asimétricas, es decir por las configuraciones más compacta aumenta.

*) On leave from the Universidad Nacional de Ingeniería, Apt. 1301, Lima, Peru

**) On leave from Kernforschungszentrum Karlsruhe, D-7500 Karlsruhe, Germany

1. INTRODUCTION

The structure in the mass and charge distributions in low energy fission of heavy nuclei have been interpreted as stemming from shell and pairing effects [1]. In the case of ^{234}U and ^{236}U produced in the capture of a thermal neutron by ^{233}U and ^{235}U , respectively, those structures are more pronounced at high kinetic energy, E_L , of the light fragments [1]. This result promoted the measurement of charge, mass and kinetic energy in regions with small excitation energy of fragments, that is, as close as possible to the region of cold fission, defined as fission with no neutron emission. In the region of cold fission mostly the systems ^{234}U and ^{236}U were studied. Several authors [2-4] measured with the "Lohengrin" recoil separator the light fragment mass (A_L), and the light fragment charge (Z_L) distributions in windows of light fragment kinetic energy (E_L). A time of flight method has been used by other authors [5,6] to measure the total kinetic energy (TKE) and fragment mass distribution for the above mentioned fissioning systems. From those measurements the maximal value of TKE, TKE_{max} , as a function of A_L has been evaluated. A recent review of cold fission is given in Ref. [7].

The purpose of this paper is to disentangle the influence of the Coulomb energy from other effects. An increase of TKE_{max} is observed for increasing charge asymmetry for mass fragmentations with equal Q-values of the same members of the mass chain. The maximal value of the Coulomb interaction energy between the two fragments at scission, C_{max} , will be calculated in a static scission model and compared to the experimental values of TKE_{max} . The analysis allows to understand the yields of the surviving charges in the region of the highest values of the total kinetic energy.

2. THE MOST COMPACT SCISSION CONFIGURATION

At scission the potential energy of a two fragment system (P) is the sum of the total deformation energy (D) and the mutual Coulomb energy (C). The light and heavy fragments could have intrinsic excitation energy (X). In addition, the two fragments could have obtained a prescission total kinetic energy (TKE_0). Using these definitions, the energy balance, neglecting shell and pairing energies, at the scission configuration is given by the following equation:

$$Q = D + X + C + TKE_0, \quad (1)$$

where Q is the available energy for the fission process.

The most compact scission configuration corresponds, by definition, to the highest Coulomb interaction energy. It is assumed that this configuration consists of fragments in their ground states, without pre-scission kinetic energy. Then equation (1) reduces to:

$$Q = P_{\max} = D + C. \quad (2)$$

Note that this configuration corresponds to the maximal value of the potential energy (P_{\max}) which cannot be higher than the Q -value. From relation (2) we see that the highest possible value of the mutual Coulomb energy (C_{\max}) corresponds to the lowest possible deformation energy (D_{\min}). In order to calculate the most compact scission configuration, the deformation energy and the Coulomb interaction energy as a function of the shape of the configuration is needed. The energy C_{\max} can be taken as the maximum value of the TKE of the fragment pair. The energy D is transformed into excitation energy of the fragments.

2.1. COULOMB EFFECT

Let Z_L/Z_H and $(Z_L-1)/(Z_H+1)$ be two charge fragmentations for the same mass ratio A_L/A_H . Assuming that the corresponding scission configurations have the same deformations, the ratio between the corresponding C -values is the following:

$$C_{Z_L}/C_{Z_L-1} = Z_L Z_H / (Z_L-1)(Z_H+1). \quad (3)$$

The Coulomb interaction energy, at the most compact scission configuration, amounts to about 200 MeV. For the difference ($C_{Z_L} - C_{Z_L-1}$) a value of about 2 MeV is obtained. In Fig. 1, the curves C , corresponding to Z_L and (Z_L-1) , respectively, are schematically presented as a function of fragment deformation. Let us assume that the deformation energy and the Q -values are the same for the two charge fragmentations. It is easy to see that the smallest value of the deformation energy (D_{\min}) and the largest value of the maximal total kinetic energy (TKE_{\max}) correspond to the most asymmetric charge fragmentation. The lower of the two light fragment charges with the higher value of the TKE_{\max} has a higher fission yield. This observation we call the Coulomb effect in the independent yield. A consequence of this yield difference are oscillations in the mass dependence of TKE_{\max} .

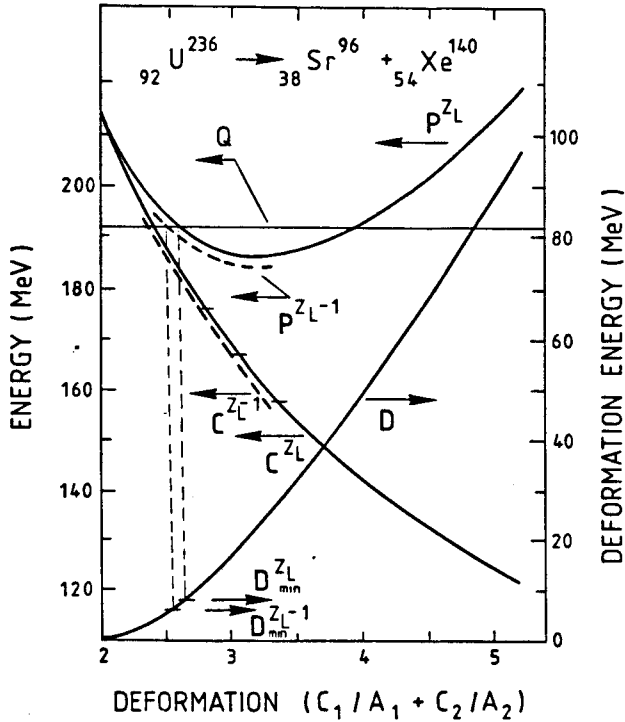


Fig. 1: Total deformation energy (D) and Coulomb interaction energy (C) of the scission configurations limited by the total available energy (Q) for the fragmentation ${}^{96}\text{Sr}/{}^{140}\text{Xe}$ [from Ref. [1]]. The charge ratio Z_L/Z_H is equal to $38/54$. If one assumes a second charge fragmentation $(Z_L-1)/(Z_H+1) = 37/55$ having the same Q -value one will obtain a total kinetic energy TKE^{Z_L-1} higher than the one corresponding to the first fragmentation TKE^{Z_L} .

2.2. Q-VALUE INFLUENCE

The Q -value limits the domain of fragment deformations at the scission configurations, as one can see in the schematic figure 1. Let us take two charge fragmentations corresponding to the Q -values Q' and Q'' , deformation energies D'_{\min} and D''_{\min} , and the total kinetic energy TKE'_{\max} and TKE''_{\max} , respectively. If $Q' < Q''$, we see from Fig. 1 that $D'_{\min} > D''_{\min}$. The difference between the TKE_{\max} values will be higher than the difference between the corresponding Q -values. It equals the sum of the differences of the Q -values and the deformation energies.

2.3. SHELL AND PAIRING INFLUENCE

The fragment deformabilities play an important role in the magnitude of the Coulomb effect. For example the TKE_{\max} would be constant if the fragment deformation would not depend on the deformation energy in the

domain of the most compact scission configuration. This means that, if the fragments are soft the difference in the TKE_{\max} will vanish.

In order to estimate the role played by the deformation, one can calculate, for each fragment, the deformation energy, using the Strutinsky prescription [8]. The shell [9], δU , and the pairing [10], δP , terms are added to the liquid drop energy [11], W .

The relative variation of the deformation energy of a fragment is calculated by the difference

$$\theta = (\tilde{W} + \delta U_N + \delta U_Z + \delta P_N + \delta P_Z) - \tilde{W}_s, \quad (4)$$

where \tilde{W} and \tilde{W}_s are the smoothed values, corresponding to deformed and spherical shapes of fragments, respectively. $\delta U_{N,Z}$ and $\delta P_{N,Z}$ are the shell and the pairing terms corresponding to neutrons and protons, respectively.

The maximal value of the Coulomb interaction energy, at the scission configuration, is calculated as the difference between the Q -values and the deformation energies of the fragments. As an example in Fig. 2 are

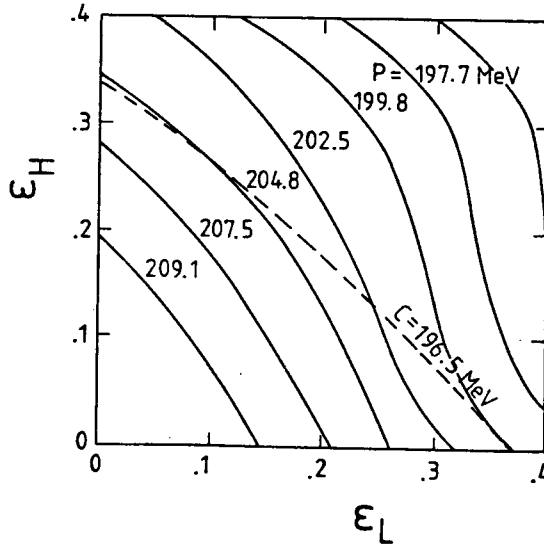


Fig. 2 Equipotential energy (—) as a function of deformation at scission of the fragmentation $^{92}\text{Sr}/^{138}\text{Xe}$. The fragment deformations are represented by the Nilsson parameters ϵ . The dashed line is the equi-Coulomb interaction energy corresponding to the highest value permitted by the Q -value = 204.2 MeV. The most compact configuration correspond to $\epsilon_L = 0.4$ for and $\epsilon_L = .0$ for the light and the heavy fragment, respectively.

presented equipotential energy curves (P) as a function of the Nilsson deformation parameters (ϵ) at scission for the fragmentation $^{98}\text{Sr}/^{138}\text{Xe}$. For a Q-value of 199.8 MeV, the maximal value of the Coulomb energy is $C_{\text{max}} = 196.5$ MeV giving a total deformation energy of 3.3 MeV. The corresponding configuration is the heavy fragment in its spherical shape and the light fragment with a deformation $\epsilon = 0.37$. Fig. 3 shows the fragmen-

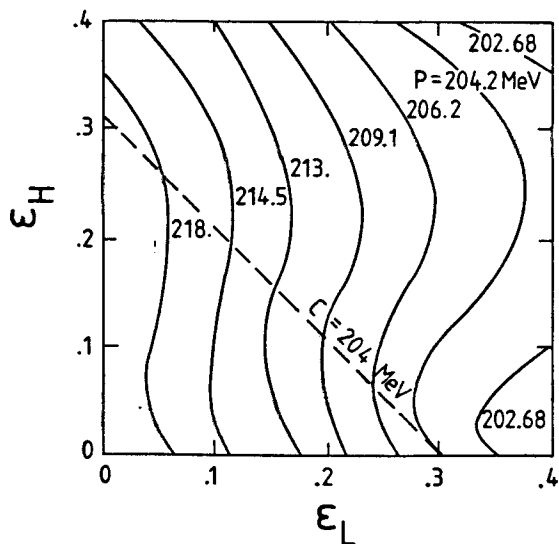


Fig. 3: Same as Fig. 2, but for the fragmentation $^{104}\text{Mo}/^{130}\text{Sn}$. The most compact scission configuration corresponds to the light fragment deformation $\epsilon_L = 0.3$ (ground state) and the heavy fragment deformation $\epsilon_H = 0$ (ground state).

tion $^{104}\text{Mo}/^{130}\text{Sn}$. Here C_{max} reaches the Q-value because the deformation energy of this fragmentation approaches zero. The C_{max} -values for the two fissioning systems ^{234}U and ^{236}U as a function of fragment mass are presented in Figs. 4 and 5.

3. INTERPRETATION OF EXPERIMENTAL DATA

3.1. COULOMB EFFECTS

Fig. 4. The maximal kinetic energy, TKE_{max} , (thick line) [16]; the maximal Coulomb interaction energy, C_{max} , (thick dashed line) [8] and the highest Q -values (The full and dotted lines correspond to even and odd charge fragments, respectively) as a function of the light fragment mass, in the fission of ^{235}U induced by thermal neutrons. TKE_{max} and C_{max} are shifted by -5 MeV for visual clarity.

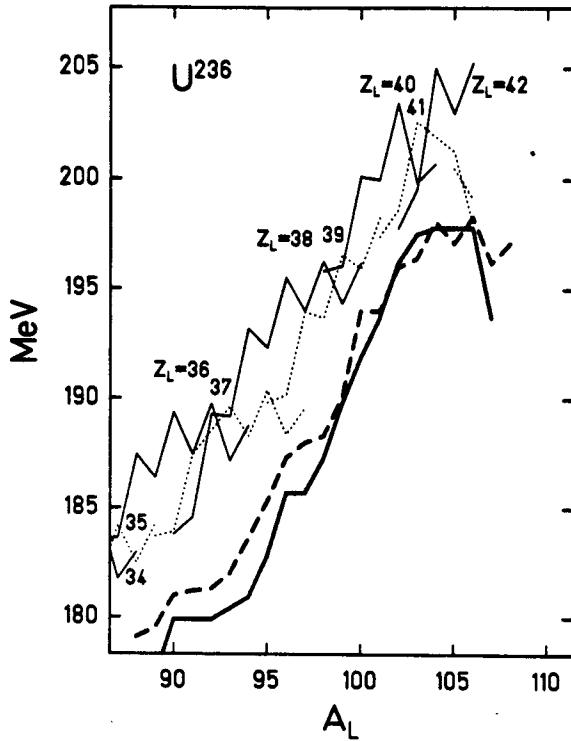
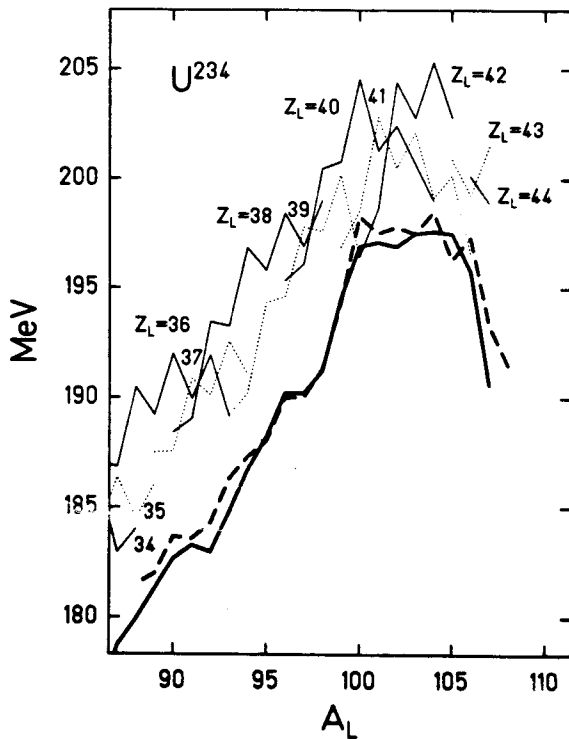


Fig. 5. Same as Fig. 4, but for the reaction $^{235}\text{U}(n_{th},f)$.



In tables 1 and 2 are shown yield data for the systems ^{236}U [4], and ^{234}U [3] for several pairs of isobaric fragmentations (with the same mass ratio) where the Coulomb effect can be observed. For each system, the light fragment kinetic energy (E_L) is fixed. The fragmentations are indicated by the light fragment mass (A_L), the corresponding total kinetic energy (TKE), the light fragment charge, Z_L and Z_L' , the Q-values (from Ref. [12]), Q and Q', and the yield, Y and Y', respectively. For comparison the mass range $A = 87-97$ has been chosen which is not affected by shell effect.

Let us take, for example, the system ^{236}U . See table 1. Lang et al. [4] have measured the charge and the mass distribution for E_L equal to 108 MeV. This energy window corresponds to the TKE-line 10 MeV lower on the average than the maximal Q-line. Let us take the mass fragmenta-

Table 1: Reaction $^{235}\text{U}(n_{\text{th}}, f)$. The yields Y and Y' of two charges Z_L and Z_L' corresponding to very close fragment kinetic energies were fixed at $E_L = 108$ MeV. Q-values (Ref. [12]) Q and Q', respectively. (Taken from Ref. [4]).

A_L	Z_L/Z_H	N_L/N_H	Z_L/Z_H	N_L/N_H	Q (MeV)	Q' (MeV)	Y(%)	Y'(%)
106*	43/49	63/81	44/48	62/82	199.2	199.2	5.7±3.2	0.
103	40/52	63/81	42/50	61/83	199.9	199.6	22.6±3.2	24.7±3.2
102	39/53	53/81	41/51	61/83	198.6	197.8	39.0±2.4	4.9±1.7
101	39/53	62/82	41/51	60/84	198.3	197.4	4.5±0.9	21.7±2.3
100	41/51	59/85	42/50	60/84	192.6	189.7	8.6±5.9	0.7±0.7
100	38/44	62/82	39/43	61/83	196.2	195.9	0.5±0.5	8.2±1.5
99	39/53	60/84	40/52	59/85	196.6	196.0	45.0±3.1	47.2±3.4
98	38/54	60/84	40/52	58/86	196.3	195.8	33.0±5.5	21.8±2.9
97	38/54	59/85	39/53	58/86	194.0	194.0	54.8±3.3	39.1±3.0
96	39/53	57/87	40/52	56/88	190.2	190.0	12.5±1.5	1.4±0.9
95	37/55	58/86	39/53	56/88	190.4	189.8	15.8±1.5	10.5±1.5
93	37/55	56/88	38/54	55/89	189.6	189.2	64.2±3.7	21.8±3.5
92	36/56	56/88	38/54	54/90	189.8	189.3	53.4±3.1	6.3±1.9
91	36/56	55/89	37/55	54/90	187.5	187.5	75.9±3.3	19.7±3.1
90	37/55	53/91	38/54	54/90	183.9	183.8	4.4±2.6	.0
89	35/57	54/90	37/55	52/92	184.3	183.7	29.3±2.3	3.5±2.1
88	34/48	54/90	35/57	53/91	183.0	182.5	10.4±1.4	50.7±2.5
87	35/47	52/92	36/51	51/93	184.2	183.6	45.6±3.0	10.1±2.0
85	34/48	51/93	35/57	50/94	182.9	182.3	90.0±2.6	3.3±2.1

(*) For $A_L = 106$ the light fragment kinetic energy is taken equal to 98.9 MeV

Table 2: Reaction $^{233}\text{U}(n_{\text{th}}, f)$. The yield Y and Y' of two charges Z_L and Z_L' corresponding to very close Q -values (Ref. [12]) Q and Q' , respectively. The light fragment kinetic energies were fixed at $E_L = 110.55$ MeV. (Taken from Ref. [3]).

A_L	Z_L/Z_H	N_L/N_H	Z_L'/Z_H	N_L'/N_H	Q (MeV)	Q' (MeV)	$Y(\%)$	$Y'(\%)$
105	41/51	64/78	43/49	62/80	200.2	200.9	37.3±23.	6.4±1.3
104	40/52	64/78	41/51	63/79	199.0	199.2	5.4±2.6	20.6±7.4
103	40/54	63/79	43/49	60/82	198.5	199.1	16.0±6.2	1.9±0.7
103	41/51	62/80	42/50	61/81	202.1	202.8	47.7±10.	34.4±6.7
101	40/52	61/81	41/51	60/82	201.3	202.8	61.8±2.4	31.7±1.9
100	39/53	61/81	42/50	58/84	196.4	196.4	4.0±1.4	0.2±0.0

97	38/54	59/83	40/52	57/85	196.9	196.1	24.3±2.0	10.1±1.5
96	39/53	57/85	40/52	56/86	194.6	195.3	23.8±1.7	3.6±0.8
93	37/55	56/86	38/54	55/87	192.5	193.3	46.0±4.1	47.3±6.1
92	36/56	56/86	38/54	54/88	191.9	193.5	20.7±2.6	12.7±1.1
92	37/55	55/87	38/54	54/88	190.1	193.5	67.5±3.0	12.7±1.1
91	36/56	55/87	37/55	54/88	190.0	190.9	50.0±2.7	46.4±4.0
90	37/55	53/89	38/54	52/90	187.6	188.4	13.7±1.0	1.1±0.3
89	35/57	54/88	37/55	52/90	186.1	185.1	5.8±3.0	2.8±0.2
87	35/57	52/90	36/56	51/91	186.4	186.9	54.4±2.5	33.1±2.0
86	34/58	52/90	36/56	50/92	186.3	187.1	53.2±3.9	7.1±1.1
86	35/57	51/91	36/56	50/92	184.2	187.1	37.2±4.9	7.1±1.1
85	34/58	51/91	35/57	50/92	184.5	185.0	76.7±3.2	18.5±1.3
85	32/60	53/89	37/55	58/94	170.7	172.1	1.3±0.2	0.5±0.1

tion 91/135. The light fragment charges $Z_L = 36$ and 37 have the same Q -value ($=187.5$ MeV) but the charge $Z_L = 36$ has a yield ($Y = 75.9 \pm 3.3$) higher than $Z_L = 37$ ($Y' = 19.7 \pm 3.1$). Trochon et al. [13] identified, in the case of ^{236}U , the surviving charge for the highest values of TKE. The charge corresponds, in most cases to the maximal Q -value. But the surviving charge, for the fragmentation $A_L/A_L = 91/145$ was again found to be $Z_L/Z_L = 36/54$ in contrast to the hypothesis of highest Q -value which correspond to the charge fragmentation 37/55.

For $A_L = 93$, the highest Q -value corresponds to $Z_L = 38$ ($Q = 189.2$ MeV). The Coulomb effect shifts for the most compact configuration the charges downward to $Z_L = 37$ ($Q=189.6$ MeV) as has been seen in the experimental data obtained by Lang et al. [4]. The charge $Z_L = 37$ has a higher yield ($64.2 \% \pm 3.7$) than for $Z_L = 38$ ($21.8 \% \pm 3.5$).

The mentioned experimental results exhibit Coulomb effects in the yields for fragmentations corresponding to Q -values other than the highest ones. For example, for $A_L = 95$, the maximal Q -value (192.3 MeV) cor-

respond to $Z_L = 38$. Nevertheless, one can compare two fragmentations in a pair corresponding to lower Q-values. For instance, the charge $Z_L = 37$, the corresponding Q-value which is 190.7 MeV, has a yield ($Y = 15.8 \% \pm 1.5$) higher than $Z_L = 39$ ($Y' = 10.5 \% \pm 1.5$) despite of their very close Q-value.

Let us now draw the consequences of the Coulomb effect on the high TKE-lines presented in Figs. 4 and 5 for the systems ^{236}U and ^{234}U , respectively. In both cases, shoulders in the TKE-lines are observed [14]. These shoulders could be interpreted by the Coulomb effect as follows.

Let us take, for example, the TKE-lines of ^{236}U , presented in Fig. 4. Assuming that the most compact scission configurations correspond to the maximal Q-value the oscillations in the TKE-lines can not be explained. In Sect. 2.1 we have learnt when two charges Z_L correspond to very close Q-values, for high TKE-values the Coulomb effect favours the yield of the lowest Z_L . This assumption allows to interpret the mentioned shoulders.

The TKE-lines with a slope of 2.5 MeV/amu have a very pronounced shoulder for the region from $A_L = 93 - 90$. This shoulder can be interpreted as follows: From $A_L = 96$ to 94 the maximal Q-values are very high relative to the corresponding second Q-values. Then, the charge corresponding to that maximal Q-values ($Z_L = 38$) will survive up to TKE_{max} . For $A_L = 93$, the charge $Z_L = 37$ has the Q-value = 189.63 MeV which is the maximal and higher than that for $Z_L = 38$ ($Q = 189.18$). Then the charge favoured by the Coulomb effect will be the lower one ($Z_L = 37$). The change of Z_L from 38 to 37 for the change of A_L from 94 to 93 will produce an increase of TKE relative to the extrapolation from the region $A_L = 96 - 94$.

For $A_L = 92$, the charge $Z_L = 36$ will survive up to TKE_{max} , because it is in competition with a higher Z_L ($= 38$). Then the change of Z_L from 37 to 36, for the transition from $A_L = 93$ to 92 will produce, as before, a relative increase of TKE, making the mentioned shoulder more pronounced.

Let us take the system ^{234}U . See Fig. 5. The TKE-value corresponding to $A_L = 91$ is higher than the extrapolation from $A_L > 91$. The charge decreases from $Z_L = 38$ ($A_L = 92$) to $Z_L = 37$ ($A_L = 91$). Moreover, from $A_L = 91$ to 90, Z_L decreases from 37 to 36 producing, by the Coulomb effect the pronounced shoulder in this mass region.

3.2. INFLUENCE OF THE Q-VALUE

Let us consider the ^{234}U system. In order to separate the Q-value influence from the other effects one takes the fragmentations $^{104}\text{Mo}/^{130}\text{Sn}$ and $^{106}\text{Mo}/^{128}\text{Sn}$, the corresponding Q-values of which are 205.3 MeV and 204.7 MeV. From the energy balance unique charges were attributed for those fragmentations [5,6]. In Fig. 5 one can see that the TKE_{max} -value corresponding to the mass fragmentation 104/130 is higher than the TKE_{max} -value corresponding to the mass fragmentation 106/128.

Let us consider the fragmentations $^{96}\text{Sr}/^{138}\text{Xe}$ and $^{94}\text{Sr}/^{140}\text{Xe}$, their Q-values being 198.4 MeV and 196.8 MeV, respectively. One has chosen those fragmentations because the Q-value of their neighbouring charge splits are relatively low making reasonable the hypothesis of pure charge fragmentations. One can observe that the difference between the TKE_{max} values is higher than the difference between the corresponding Q-values, as expected and as explained by the influence of the Q-value (c.f. subsection 2.3).

Let us take the system ^{236}U . For $A_L = 90$ the maximal Q-value (189.4 MeV), corresponding to $Z_L = 36$ is much higher than the second Q-value (183.9 MeV) corresponding to $Z_L = 37$. Then, the surviving charge will be $Z_L = 36$. From this reasoning and from the discussion in subsection 3.1, one can say that for $A_L = 92 - 90$ the charge fragmentation will be 36/56. The Q-value corresponding to $A_L = 90$ ($Q = 189.4$ MeV) is very close to the Q-value corresponding to $A_L = 92$ ($Q = 189.8$ MeV). This fact is the reason why the corresponding TKE_{max} -values are also very close. In this case the influence of the Q-value will enlarge the shoulder in the TKE-lines, which begins at $A_L = 93$ as it is observed in the Fig. 4 and has been mentioned in the Sect. 3.1.

3.3. SHELL AND PAIRING EFFECTS

Experimental results of fragment yields in the mass range $A = 98-106$ cannot be explained by the Coulomb effect. The reason for that is the softness of the fragment which diminishes the Coulomb effect. Moreover, according to equation (3), the Coulomb effect decreases with increasing Z_L , and the indicated mass range corresponds to the highest observed Z_L values.

Moreover, in the system ^{234}U at $E_L = 110.55$ MeV presented in table 2 the light fragment ^{104}Nb ($Q = 199.2$ MeV) is favoured as compared to

^{104}Zr ($Q = 199.0$ MeV). This result could be interpreted as a product of a nucleon pair breaking in the case of even-even fragments.

In subsection 2.3 has been presented the calculation of the maximal value of the Coulomb interaction energy at scission. For the fragmentation $^{104}\text{Mo}/^{130}\text{Sn}$ a TKE_{max} very close to the corresponding Q -value was found in agreement with the calculated C_{max} (see Fig. 4). The heavy fragments, neighbours of the doubly closed spherical shell nucleus ^{132}Sn and the light fragments in the region $Z_L = 40-42$ and $N_L = 60-64$ corresponding to deformed nuclei [15,16] constitute the fragmentation with the lowest excitation energy. The deformation properties, caused by shell and pairing effects, could be also responsible for the structures in the TKE-lines. The C_{max} calculated by the method explained in subsection 2.2. for the cases ^{234}U and ^{236}U are in agreement with the experimental TKE-lines, see Figs. 4 and 5.

4. DISCUSSION

In order to observe the Coulomb effect on the charge yield one has to separate out other effects. One has to chose pairs of fragmentations having very close Q -values and negligible shell effects. One also has to take pairs of fragmentations with the same number of broken nucleon pairs. In order to exclude all the mentioned effects one can take the average charge as a function of light fragment mass for increasing values of the kinetic energy. Lang et al. [4] have obtained the deviation, ΔZ , of the average nuclear charge Z_L from the unchanged charge density value Z_{UCD} . Results corrected for neutron emission show that in the mass region $A_L = 85 - 98$ Z_L decreases as a function of the light fragment kinetic energy as expected from the Coulomb effect.

In order to give more proofs for the Coulomb effect one can take the example of $A_L = 92$ and the charges $Z_L = 36$ and $Z_L = 38$. The liquid drop energy of spheroidal configurations and the Coulomb interaction energy are calculated and no shell effects in the fragment energies are taken into account. The distance between the fragment's tips is taken equal to 2.0 fm.

For the charge $Z_L = 36$ ($Q = 189.8$ MeV) the most compact configuration fulfilling equation (2) corresponds to a fragment deformation $\beta_L = 0.40$ and $\beta_H = 0.30$, respectively. For the charge $Z_L = 38$ ($Q = 189.2$ MeV) the most compact configuration corresponds to $\beta_L = 0.35$ and $\beta_H = 0.50$, respectively. The maximal Coulomb energy corresponding to $Z_L = 36$ ($C_{\text{max}} = 180.6$ MeV) is higher than $Z_L = 38$ ($C_{\text{max}} = 176.8$ MeV) despite of its lower Q -value. This result shows that Coulomb effects could explain

the reverse trend of the maximal kinetic energy with respect to the Q-values.

5. CONCLUSION

The experimental results on charge, mass and kinetic energy distribution of the systems ^{234}U and ^{236}U have been analysed. Our consideration leads to the conclusion that the Coulomb interaction energy as a function of the fragment deformation as well as the total fragment energy as a function of deformation influence the scission configuration with a similar importance as the role played by the Q-value. The oscillations in the TKE_{max} lines as a function of the light fragment mass can be interpreted by the Coulomb effect, the influence of the Q-value and by shell effects. The Coulomb effect is higher for the most asymmetric fragmentations and it is negligible for the soft fragments $A_L \approx 100$.

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