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COMMENTS ON "CHEMICAL SEPARATION OF KURCHATOVIUM"*†

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The Editor has asked for our comments on the paper of Zvara et al., inasmuch as the work reported seems to bear upon the discovery of element 104.

In the present paper this Dubna group now interprets the ephemeral "kurchatovium" activity (which, it should be remembered, originally was characterized with a half-life of 0.3 seconds) in terms of an assumed spontaneous-fission branching decay of the nuclide, ^{259}Rf. This isotope of rutherfordium was discovered by our group[1] and characterized as a 3-second alpha emitter with main alpha-particle groups at 8.86 and 8.77 MeV. For the following reasons we cannot agree that the new experiment which they report upon does support their claim to prior discovery of element 104.

1. At present we have only set an upper limit of 20% for the SF branching of ^{259}Rf and such a limit does not by itself rule out the possibility that they have observed such a branching. It seems to us however, that it would be very surprising if the branching is high enough ($\approx$ 10%) to account for the fissions observed in the Dubna experiments. Recall that ^{261}Rf, a 65-second alpha emitter discovered by our group,[2] has already been shown to have an SF T1/2 greater than 500 seconds and this isotope has two more neutrons than ^{259}Rf. From the precipitous slope[3,4] of SF T1/2 vs N for nuclides with more than 152 neutrons one would expect the half life of ^{259}Rf to be orders of magnitude longer than that of ^{261}Rf.

2. It should be noted that the new Dubna experiment gives no information about the half-life of the activity responsible for the fissions observed in section III of their apparatus. They assume that the half-life must be the same as that observed in recent purely physical experiments in which a 4.5-second SF activity was observed.[5] In a paper[6] published in 1966 it was pointed out that as much as 2% of the gross activity produced in a given experiment was able somehow to pass through a hot filter interposed in the chromatographic column line. It would seem logical to us to expect a much greater fraction to pass downstream through a straight tube which did not have any filter at all and consequently we wonder whether the ^{256}Md-^{256}Fm SF-emitting duo could conceivably be responsible for the 16 events observed.

3. A rather puzzling result of the new experiment is the apparent absence of the 0.1-sec (née 0.3-sec) "kurchatovium" atoms which should have decayed "in flight" in section II of their chromatographic column. From their previous work this "^{260}Ku" activity should be almost as abundant as the "4.5-sec" activity. Does this prove chemically that the 0.1-sec spontaneous fission activity is <u>not</u> due to element 104? If so, then it is worth noting that the non-chemical angular-collimation and excitation-function evidence that "proved" that it was due to element 104 is of the same character as that which purportedly showed that the 4.5-sec activity was due to that element.

We believe that these comments raise some valid questions as to whether or not "element 104 (kurchatovium-Ku) was chemically isolated and identified." We hope to provide satisfactory answers in some new experiments which we will undertake in the near future.

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