

## RESPONSE

by Leo Szilard

In 1913, <sup>one year</sup> ~~one day~~ before the first World War, H.G. Wells published a book entitled "The World Set Free" in which he predicts the discovery of artificial radioactivity and puts it into the year of 1933, the year in which it actually happened. In this book, Wells describes how this discovery is followed by the release of atomic energy on an industrial scale, the development of the atomic bomb and a world war which is fought with such bombs. London, Paris, Chicago and many other cities are destroyed in this war, which Wells puts into the year of 1956. I read this book in 1932, before I myself had done any work in the field of nuclear physics.

In 1933, I went to live in London. In the fall of that year, the London papers reported a speech given by Lord Rutherford at a meeting of the British Association, in which he said that whoever talked of the release of atomic energy on an industrial scale was talking moonshine. I was pondering about this while strolling through the streets of London. On that occasion, it occurred to me that Rutherford might be wrong, because there might exist an instable element that splits off neutrons - when bombarded by neutrons - and such an element could sustain a nuclear chain reaction. On the basis of the published masses of helium and beryllium, the beryllium nucleus should have been instable and it could have disintegrated into two alpha particles and one neutron, when hit by a neutron.

At that time, I was playing with the idea of shifting to biology. But the possibilities opened up by these thoughts were so intriguing that I moved into nuclear physics instead.

In the summer of 1934, T.A. Chalmers and I looked into the mystery of beryllium and we found that beryllium emits neutrons when exposed to the gamma rays of radium. Other experiments showed, however, that gamma rays of lower energy were incapable of splitting beryllium and this made it appear doubtful that beryllium could sustain a nuclear chain reaction.

Nevertheless, the thought that some element or other might be capable of sustaining such a chain reaction stayed with me and I pursued it from time to time without success until I finally gave up hope in the fall of 1938. In December of 1938, I so advised the British Admiralty, to whom I had previously assigned a secret British patent which described the general laws governing nuclear chain reactions. One month later, I visited Wigner, who was ill with jaundice in Princeton. On that occasion, I learned from him that Hahn and Strassman had found that the uranium nucleus breaks into two heavy fragments when it absorbs a neutron. To me, it appeared at once very likely that these fragments would evaporate neutrons and this meant that uranium might sustain a chain reaction. "H.G. Wells, here we come!" - I said to myself. Neither Wigner nor I had much doubt at that time that we were on the threshold of a World War. Finding out whether neutrons are emitted in the fission of uranium appeared to us therefore as a matter of great urgency.

The rest is history.

In 1945, as the war drew to its end, one of the younger staff members came into my office at the Uranium Project at the University of Chicago and said that he felt it was a mistake that so much emphasis was placed on the bomb and that we were not paying sufficient attention to the peacetime applications of atomic

energy. "What particular peacetime applications do you have in mind?" I asked him, and he said, "The driving of battleships." I often told this story after the war as a joke. These days, when we are rapidly moving towards the <sup>long-range rocket stage of the</sup> so-called atomic stalemate, it seems to me that the story is even better, because it now represents two jokes rather than just one.

It is not always easy to say what is or is not a peacetime application of atomic energy, but if the large-scale liberation of atomic energy which we have achieved abolishes war, as it well may, the distinction will cease to be important. If war is to be abolished, the nations of the world must either enter into a formal agreement to get rid of the bomb or they must reach a meeting of the minds on how to live with the bomb. So far, we have not made much progress in either direction. It seems likely, however, that, as far as America is concerned, she will be forced to decide in favor of one or the other of these two alternatives during the term of office of the next President, and either decision might be better than no decision.