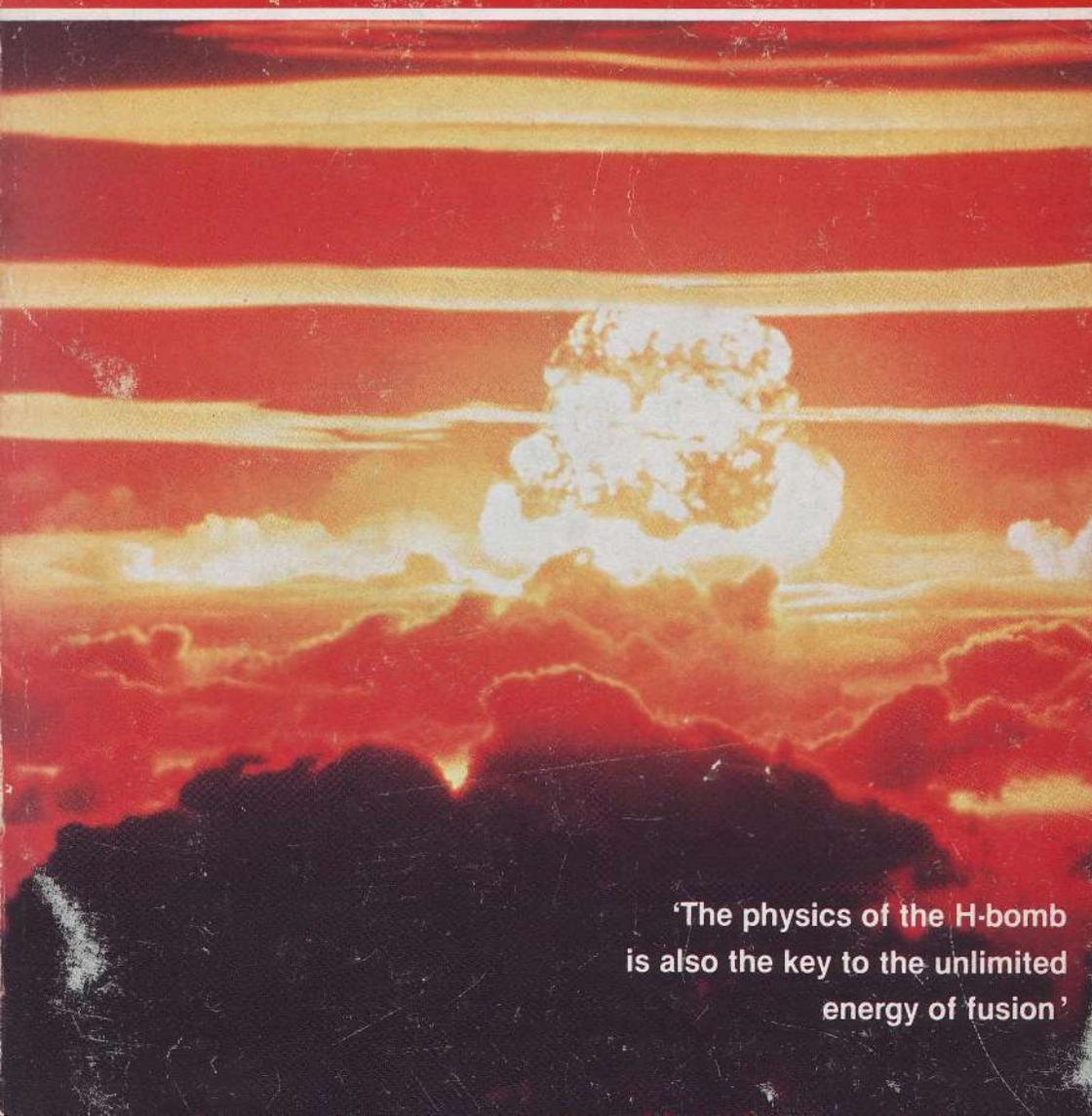


**FRIEDWARDT WINTERBERG**

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# **The Physical Principles Of Thermonuclear Explosive Devices**



**'The physics of the H-bomb  
is also the key to the unlimited  
energy of fusion'**

*The Physical Principles  
Of Thermonuclear  
Explosive Devices*

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FRIEDWARDT WINTERBERG

University of Nevada

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## *Foreword*

It is appropriate that this, the first volume in the Fusion Energy Foundation series of books on the frontiers of science and technology, should have as its subject the basic physics of thermonuclear explosions. The tremendous energy release from fusion reactions defines the most advanced aspects of strategic and economic policy for the last decades of the twentieth century.

It has been an unavoidable fact of life since the Manhattan Project that fusion science has been closely associated with research on thermonuclear weapons. The H-bomb first brought the process of fusion to public attention, two decades before the scientific advances that have brought fusion energy to the threshold of energy breakeven. The solution to the originally formidable problems of substantial energy release from weapons systems has been an integral part of the achievement of controlled fusion, particularly in inertial-confinement fusion.

Some form of inertial-confinement fusion will ultimately produce the most efficient and useful output of fusion energy, in all likelihood. Inertial fusion therefore defines one of the most important frontiers of civilian and military science about which citizens must be adequately informed.

This is not possible at present, however, because many of the basic ideas and results in inertial fusion are still classified. For many

years we of the Fusion Energy Foundation have fought to change this situation.

It is intolerable that the theoretical underpinnings of the science that, in the judgment of most knowledgeable individuals, will determine the future of the world should be classified. It is intolerable that the leading edge of human thought has deliberately been made inaccessible, not only to the layman, who needs to be informed, but also to the working scientist, to whom this situation poses the unacceptable choice of surrendering an independent role as a civilian scientist or being cut off from access to the principal data that relate to this most important area of research.

Dr. Winterberg's book is not only a valuable contribution toward properly informing citizens on these crucial civilian and military scientific frontiers. It also reminds us of the hydrodynamic tradition involving such pioneering figures as Ludwig Prandtl, which has proven so fruitful in modern science and technology.

If this book contributes to informing the national citizenry as well as to restoring the vigor of that scientific tradition; if it contributes to the development of new theoretical and experimental approaches to solving the problems of the fundamental processes of fusion, then it will have achieved its primary purposes. The physics of the H-bomb is also the key to the unlimited energy of fusion.

*Dr. Morris Levitt*  
Executive Director

*Dr. Uwe Parpart*  
Director of Research

FUSION ENERGY FOUNDATION  
New York City

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## *Preface*

Thermonuclear weapons are the most destructive technology ever devised by man. Why, then, some may ask, would I write such a book? Would the publication of it not accelerate the race toward more countries acquiring these weapons, ultimately leading to a thermonuclear holocaust, with casualties in excess of 600 million people, by conservative estimates, and the destruction of a large part of our cities and industries in the civilized world? The answer to this question would be yes if there ever was such a secret to guard, without which no thermonuclear weapons could be built.

This assumption, however, is totally false. The possibility of thermonuclear reactions has been known since 1928, and the discovery of nuclear fission ten years later provided a match for their ignition. The ignition of thermonuclear reactions requires temperatures of  $\sim 10^8$  K, which can be produced with an exploding fission bomb. All the remaining questions as to how fission and thermonuclear explosives would have to be arranged are technical details. The only reason that not every country with the desire to own thermonuclear weapons does not have them is not the lack of knowledge, which can be obtained from the published literature, but the extreme expense and the need for a highly developed industry to produce the required nuclear explosives, including the materials both for the fission trigger and the fusion bomb.

Fortunately, however, there is another aspect of thermonuclear