

THE QUANTUM WORLD

Welcome to the quantum world. It is a quirky and interesting world. It is the source of the stunning advances in communication and computing technology that have revolutionized the way we live. Today's communication technology seems incredible to those who grew up in the pre-television world. In the 1940s Dick Tracy had a wrist watch radio like today's cell phone. He was a hero detective in the comics. What was dreamed about has become every day use. The first television screens were based on flying electrons directed towards points on a fluorescent screen inside a heavily evacuated picture tube. Images were in black and white. Today's wall-wide flat screens were 25th century dreams. During WWII, the computers used in calculations leading to the atomic bomb were carried out on mechanical adding and multiplication machines, or were done with slide rules based on logarithm mathematics. Today's portable computers were beyond imagination. In this century we are seeing a similar revolution in diagnostic medicine, where we identify proteins produced in response to an individual's genetic code. The idea that little semiconductor-based wafers could identify an individual's gene-directed protein production was just not conceivable 2 decades ago. Choosing medical treatments based on an individual's gene-influenced chemistry is just beginning.

Cold fusion is a product of the quantum world. It is part of what is called solid state physics, where strange quantum states describe equally strange and useful behaviors. Solid state physics is being harnessed in an incredibly diverse world of new devices. The peoples of today's world use these devices in every day living as they pursue their multi-tasking lives. Historically, changes have always occurred, but the scale and rapidity of changes are faster than ever. Part of the reason is that new discoveries in the solid state physics have opened incredible new opportunities. The first few years after new technologies become available are years of relatively rapid change. After a new area of discovery has been around for a while, the pace of development usually slows. Today's exceptional rate of change is probably due to globalization. The whole world contributes to today's advances, and the dominance of a few leading countries is a thing of the past. What is learned in country A is quickly passed on to countries B, C, and D. The advances in cold fusion would have been impossible without a global sharing of experiences and views.

In the near future the quantum world will start impacting the world of energy supply. It is none too soon. We are already producing oil at close to the maximum expected rate. This rate is unsustainable over even the present century. Discovery of adequate new oil supplies is considered unlikely. The technology that supports today's 6.6 billion people depends on resources that are going to decline. Moreover, the

impact of this full utilization threatens many ecological systems that are valued by the world community. The quantum world has already begun to affect the energy field by its development of solar cells and new battery materials. These inventions are useful and can provide relief during the transitional period when fossil fuel energy is still available. But it seems doubtful that they can adequately support the fast paced society to which we have become accustomed. The New Energy technology examined here is different. It taps a resource base that can support the energy needs of 6.6 billion people for at least a billion years. The new technology makes use of a relatively unfamiliar portion of the same quantum world that has given us today's solar cells. The timing is good. We are going to need a lot of new energy by mid-century, if not before. Those who worry about global warming say that we need it now.

Like most other technology advances, like the invention of steam engines and knitting machines, most people will enjoy the benefits of the devices while not understanding the details which make them practical. However, we are in a decision-making period, which makes it important that a larger number of people understand how cold fusion works and the principles that makes it possible. Decisions based on knowledge and understanding are needed to guide investment of intellectual effort, capital, and government support. Research, development, and economic strategy will determine how soon the fruits of discovery are enjoyed. The Clean Energy cold fusion field has recently reached the point of having demonstrated heat production in several devices, but very few understand the physical and chemical science that catalyzes the configuration change that enables the new fuel to fuse and release heat. Most experimenters only know that energy release can be made to occur, but they don't know why it works. We need more persons who understand what is happening and the opportunity that it presents.

This book is really in two parts. Part 1 addresses the classical current engineering world of energy. It includes the previous chapter, which describes uranium-based nuclear fission power, and also the high temperature option of plasma fusion power. These processes are labeled "classical" because they are not really part of the quantum world. It distinguishes cold fusion from both these two classical nuclear-based processes. Part 1 then goes on to discuss early cold fusion and so-called LENR (Low Energy Nuclear Reaction) experiments, and how they have evolved toward the engineering of cold fusion heaters. This evolution is discussed in the EXPERIMENT Section of Part 1. These experiments were carried out using classical techniques and without a detailed understanding of the quantum mechanics that underpins the cold fusion process. The EXPERIMENT Section addresses the experiments that have shown that cold fusion processes have been made to occur in the laboratory, and looks at the new materials that have ensured future success. It outlines the need

for similar studies to make it a commercial success. The reader does not need to understand the quantum world to understand the nuts and bolts of the cold fusion option. Part 1 is largely understandable in terms of ordinary chemistry and classical physics. It is expected that most readers will be primarily interested in Part 1, since it explains why cold fusion is a near term solution to the growing energy-environment crisis.

Part 2 is THEORY. Cold fusion theory is very interdisciplinary. Fortunately, most of THEORY is related to atom and molecular chemistry, and can be understood in terms of chemical orbitals. The language of orbitals lends itself to pictures, so that the underlying mathematics can be largely avoided.