

**STATEMENTS FROM SIR ARTHUR C. CLARKE FOR THE
COLD FUSION: FIRE FROM WATER DOCUMENTARY
AT CLARKE'S HOME IN SRI LANKA
AUGUST 1998**

Take 1

When the original news of so-called "cold fusion" came out ten years ago, I was very excited, like almost everybody else. But then when it seemed as though it was a mistake, I more or less forgot about it, though I was very surprised that two world-class scientists could have made such fools of themselves. However. . .

Take 2

Like everyone else, I was very excited when the so-called "cold fusion" announcement was made. And then, again like everybody else, I became disappointed and forgot about the whole thing when it seemed to be a mistake, though I was rather puzzled why two world-class scientists could have made such fools of themselves. Well, during the years that followed, slowly, from time to time, there came news of other laboratories repeating the experiment and getting positive results. And there has been a sort of groundswell, all over the whole world, of new information. And during the course of the last five years or so, I've slowly become convinced, from my original skepticism, to 99% certainty that it is for real. The evidence now is really overwhelming, and I do think this is a major scandal.

There's a curious parallel back at the beginning of the century, which people have forgotten all about. When the Wright brothers first flew in 1903, no papers covered it at all, because everybody was convinced—certainly the American press—that heavier-than-air flight was totally impossible. All the top scientists said, "This is nonsense." And editors wouldn't even bother to send journalists or photographers to interview the Wrights, or even to take pictures of them flying in full public view. And it wasn't for about five years that eventually they realized, "My goodness, this is real! Heavier-than-air flight is possible." And I think a similar thing is going to happen with so-called "cold fusion"—although it's seldom cold and often isn't fusion at all.

[PAUSE IN TAPE]

I believe it was Niels Bohr who once said that new theories don't become accepted by converting the opposition. You have to wait until the opponents die, and then the next generation of scientists take the new theory for granted. Well I hope in this case it is not necessary for too many people to die before everyone realizes that there is something here. I don't like the phrase "cold fusion," because although that may exist there are obviously, or almost certainly, other forms of energy production which have nothing whatsoever to do with fusion. Some may depend on magnetic machines of some kind, which tap some source of energies. There are many theories, in fact perhaps too many theories, and that's a problem in this area. I can quite understand the scientists saying, "Well look, how does this work, if it's for real?" I think it was Eddington who once said, "I won't accept any experimental fact until there's a theory to account for it." And that's rather an exaggeration, but it's not a bad idea.

[PAUSE]

Take 1

There are some classic examples of earlier scientific scandals, which should make us think that we aren't always sure of what. . .

Take 2

I'd like to remind you of some earlier examples of scientific scandals. My favorite one concerns meteorites—stones falling from the sky. And President Jefferson, who was one of the most brilliant of all American presidents, once said, "I would sooner believe that two Yankee professors lied than that stones fall from the sky." Well, now we know that mountains fall from the sky, and there is considerable interest in this particular subject of meteor or asteroid impact on the earth. Atomic energy itself was a matter of great skepticism. Rutherford—Lord Rutherford—who uncovered the secrets of the atom, once said that the idea of getting energy from the atom was "utter moonshine." In my own field of interest—space travel—for most of my youth people thought the idea of leaving the earth was "utter bilge" to quote a remark made by a certain Astronomer Royal. Well, again

and again we have seen these new and revolutionary ideas proved, and then finally accepted and taken for granted.

[PAUSE]

Take 1

These two examples are probably unnecessary, but I'll just give them to you, and you can use them if you. . . They are relevant, but they're rather long winded. . .

Take 2

Two of my favorite examples of scientific revolutions where a heretical idea has been finally accepted are continental drift and the origin of lunar craters. Now, continental drift—the idea that the continents moved around and that once the American and European continents fitted together like a jigsaw puzzle, and then drifted apart—was regarded as absolutely ridiculous by probably 99% of geologists. In fact, someone once said that, "The only time I ever saw a man literally foaming at the mouth was when I mentioned continental drift to a distinguished geologist." Well, now we know that continental drift does occur, and that originally all the continents were stuck together and they have moved apart. So here is a total revolution which occurred actually in the last couple of decades. The other one is. . .

Another revolution is in our ideas about the craters on the moon. They look slightly like volcanoes and, until we went to the moon, most astronomers thought they were volcanic in origin. The other theory was that they were created by huge meteors splashing into the moon. But that idea was dismissed, at least in England, by most astronomers. And I am fond of quoting one who said that, "The presence of central peaks completely rules out the theory of meteor impact." Well, now we know that when a meteor does impact, it does create a central peak, and most lunar craters are in fact the result of meteor or asteroidal impact. So there is a revolution in our ideas which has taken place in a very short time and proved that old ideas, old concepts, were completely wrong.

I'm an old fashioned conservative, so I still believe in the law of the conservation of energy. Energy doesn't come from nowhere. So, if these various devices work, where do they get the energy? Well, some of these electrolytic cells—the original Pons-Fleischmann cells and

their derivatives—may be some kind of nuclear reaction: fusion of hydrogen, or deuterium, or tritium, or whatever. Others may be tapping what's known as zero point energy. Space itself is a seething mass of energy, although we are not aware of it, luckily! But there are tremendous energies in space, and one famous scientist, a Nobel Prize winner, once said, "The energy contained in a volume of space equal to a coffee mug is enough to boil all the oceans of the world." And perhaps we are beginning to tap that. It's a pretty scary idea. I've often wondered if supernovae are industrial accidents.

Another possible source of energy is something called micro-cavitation. It's a little known fact that when ultrasonic waves—very high frequency sound—pass through a liquid, they can produce bubbles. And if those bubbles collapse, preferably symmetrically, they can produce temperatures of perhaps millions of degrees, and possibly some kind of reaction may take place in ordinary water, or water enriched with deuterium or tritium, that may produce some kind of fusion. I became interested in this as a result of some news I received from Russia, which I'd like to talk about in a minute. [Potapov] Now there's only one more thing. . .

If these new sources of energy do turn out to be real—and, as I say, there are several totally different varieties—the question is: What effect will this have on our society? On the future? Well, it's just possible they may be no more than laboratory curiosities, and can't be scaled up to commercial levels. I think that's rather unlikely. Nuclear energy was once a laboratory curiosity. So let's assume that these devices can be developed. The future is then almost unlimited. It could be the end of the fossil fuel age: the end of oil and coal. And the end, incidentally, of many of our worries about global pollution and global warming. So that'll be a very good thing. If they can be made on a small scale, that could be the end of electrical distribution. In other words, every house could be totally self-contained with its power source. The automobile, belching carbon dioxide and other fumes, would be a clean device. What an effect that would have on our cities! The oil companies will simply go out of business, and the effect on the world's politics, particularly in the East, will be. . .well, staggering. And, in fact, one can imagine all sorts of unpleasant geopolitical scenarios. I hope we have the wisdom to adapt to this new order, when we are certain that it is going to come about.

[BACK TO POTAPOV]

This is one of the things that made me interested in this whole area of new energy. I hope I can. . .(lifting device) oh, it's quite a weight! This is the business end, or component, of something called a Yusmar. About five years ago I heard there was a Russian inventor, with the odd name of Potapov, who had a factory producing devices which produced more energy than went into them. They work on this principle: He has a powerful electric pump which squirts water through this thing, which he calls a vortex tube, and something happens in here. The water becomes very hot, or even steam, and apparently, about 20% more energy comes out in heat than goes in in electricity. Well, this man has had a factory running for years now, and it has produced thousands of these units, including very large ones which can heat whole apartment houses. So I sent a friend, an engineer named Chris Tinsley, who unfortunately is now dead, into Russia with a video camera and he filmed the whole operation: hundreds of these units, big units, going up for sale. And Potapov is advertising really large units now, in the megawatt range. We are still not quite certain if they do produce excess energy, but if they do, they probably depend on micro-cavitation—making bubbles which collapse and then produce tremendous temperatures. Another thing that made me take this fairly seriously is that two independent firms in the United States are producing similar devices, and selling them. Some of them don't claim to produce excess energy; they may be very, very efficient ways of turning electricity into heat. But there is some evidence that occasionally, at any rate, these things produce a little more energy going out than comes in. This is not enough to revolutionize the world as some of the other devices would. Some of the devices being advertised and even sold produce tens or hundreds of times more energy than goes into them. But these claims still remain to be completely substantiated, though I do take them seriously enough to wish that people would investigate them more carefully.

Okay . . . [Discussion of quotes for voice-overs.]

It is really quite amazing by what margins competent but conservative scientists and engineers can miss the mark when they start with the preconceived idea that what they are investigating is impossible. When this happens, the most well informed men become blinded by their prejudices and are unable to see what lies directly ahead of them.

To predict the future we need logic; but we also need faith and imagination, which can sometimes defy logic itself.

It has been said that the art of living lies in knowing where to stop, and going a little further.

When a distinguished but elderly scientist says that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong.

That's one of Clarke's laws. But my favorite Clarke law is the third, which is. . .

I'd like to give you the three Clarke's laws.

The first one: The only way of finding the limits of the possible is by going beyond them, into the impossible.

Second law: When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong.

The third law is my favorite, and perhaps the most quoted: Any sufficiently advanced technology is indistinguishable from magic.

. . .If you doubt that, look at your compact disks; look at your pocket computers. They would have been pure magic only a few decades ago.