

High-Frequency Gravitational Waves

Dr. Robert Baker on HFGW Applications

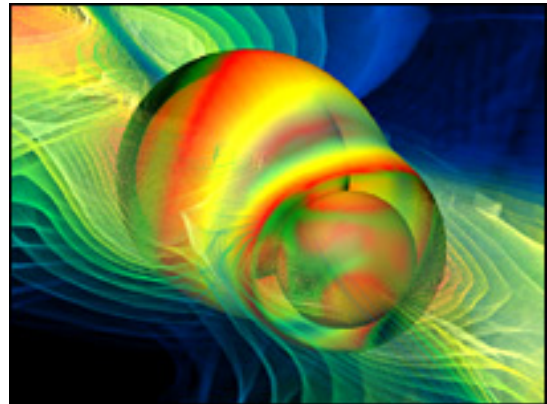
By Tim Ventura & Dr. Robert Baker, Jr., January 30th, 2006

The successful generation High-Frequency Gravitational Waves could be even more important than Marconi's development of the Radio Telegraph, and would almost guarantee a Nobel Prize for whoever accomplishes the first experiment. The basis for this technology involves creating ripples on the fabric of space-time, and has implications for everything from communications to transportation technology. Dr. Robert Baker, Jr. joins with the details about this remarkable emerging technology...

AAG: I'd like to begin with the question that everyone seems to be asking lately...What exactly are High-Frequency Gravitational Waves?

Baker: The short answer is that High-Frequency Gravitational Waves or HFGWs are ripples in the fabric of space-time whose wavelengths are small and whose frequencies are greater than 100 kHz.

Einstein called this fabric the "space-time continuum" in his 1915 theoretical work known as General Relativity (or GR). Although his theory is very sophisticated, the concept is relatively simple. This fabric is four-dimensional: it has the three usual dimensions of space: (1) east-west, (2) north-south, (3) up-down, plus the dimension of (4) time. Here is an example: we define a location on this "fabric" as 5th Street and Third Avenue on the third floor at 9 AM. We can't see this "fabric", just as we can't see the wind, sound, or gravity for that matter. Nevertheless, those elements are real, and so is this "fabric." If we could generate ripples in this fabric, then many applications become available to us.



HFGWs: Computer-modeling shows an HFGW generated by a large cosmic event.

AAG: What are some of the applications of High-Frequency Gravitational Waves?

Baker: This question is essentially answered; but the more complete answer can be found in the above cited reference: the "[Layperson's Description of HFGWs.](#)" The applications for this technology include tremendously lucrative commercial and military applications. Some examples include:



Dr. Baker: HFGW expert & experimental physicist.

1. Multi-channel communications (both point to point and point to multipoint through all material things – the ultimate wireless system). One could communicate directly through the Earth from New York to Beijing, China without the need for fiber optic cables, microwave relays, or satellite transponders – antennas, cables, and phone lines would be things of the past!

2. A remote means for causing perturbations to the motion of objects such as missiles (anything from bullets to ICBMs), spacecraft, rogue comets or minor planets, land or water vehicles or craft – a totally new propulsion system!

3. Remote coalescing of clouds of hazardous vapors, radioactive dust, etc. by changing the gravitational field in their vicinity.

4. The potential for through-earth or through-water “X-rays” in order to observe subterranean structures, geological formations (such as oil deposits), create a transparent ocean, view three-dimensional building interiors, buried devices, etc.; and

5. The potential for remotely disrupting the gravitational field in a specific region of space and even producing nuclear reactions there!

AAG: What kind of mainstream scientific support is there for HFGW physics? I’ve heard that there’s good support from work by Landau & Lifshitz, Hawking, and many other recognized scientific authorities...

Baker: The “mainstream support” can be found in the “[HFGW References 2006](#)”, and represent about 100 scientific peer-reviewed papers concerning HFGWs. A more general discussion of such support is included in “[A Brief History of HFGWs](#)”.

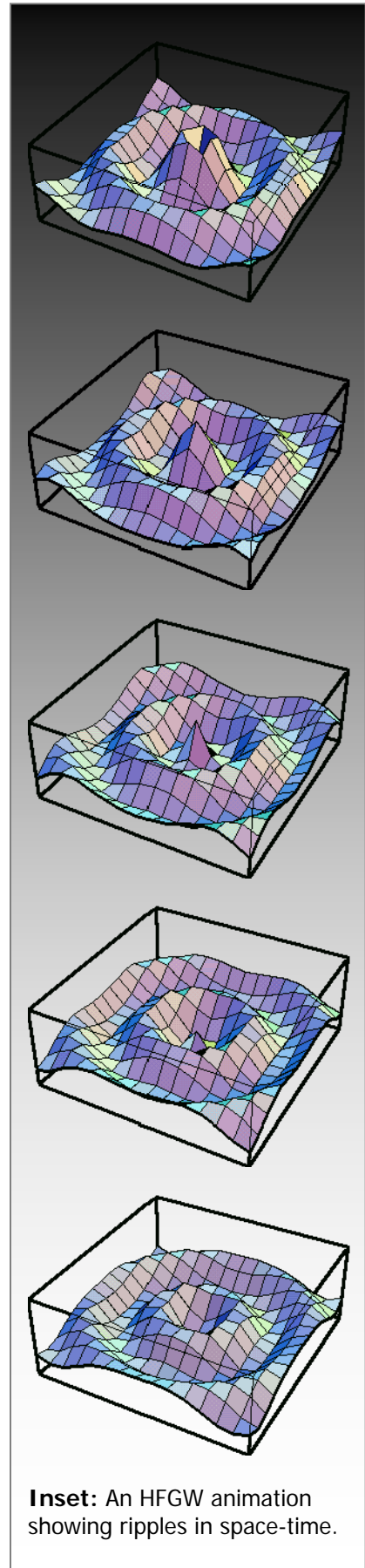
AAG: Where did the idea for HFGW's originate?

Baker: As far as I can determine the actual term “High-Frequency Gravitational Waves” or HFGWs originated with Dr. Robert Forward in 1961. As far as the “idea” for HFGWs is concerned it is discussed in “A Brief History of HFGWs.”

I had invited him over from the *Hughes Research Laboratory* in Malibu, California to deliver a lecture on the “Weber Bar” that he and Dr. Joseph Weber were constructing at the Hughes Lab to detect Low-Frequency Gravitational Waves. After the lecture Bob and I talked about building a Laboratory generator and detector for “High-Frequency Gravitational Waves.” As far as I know this was the first time the subject had been broached.

AAG: What is your background, and how did you originally get involved with HFGW research?

Baker: My educational background was at UCLA where I received a Bachelor of Science degree in Physics (scl), a Masters Degree in Nuclear Physics and PhD in Engineering with specializations in Astronomy (Celestial Mechanics), Fluid Mechanics and Electromagnetic Theory – UCLA trumpeted my degree as being “... the first Aerospace degree granted in the Nation!” My curriculum vitae, found at drrobertbaker.com, have more detail of my background. My interest in HFGW research basically began in the 1950’s when Dr. W. B. Klemperer (a well-



Inset: An HFGW animation showing ripples in space-time.

known Aerospace scientist working at Douglas Aircraft Company) and I became interested gravitational-gradient fields. In 1957 we published a paper on the subject ("Satellite Librations," Astronautica ACTA, Fasc. 1, 16-27) and it was this paper that attracted the attention of Dr. Robert Forward and started me off on my involvement with HFGW research.

AAG: How has your research evolved over time, and what direction is it going in?

Baker: As an Engineer I am interested in the practical application of science and technology not theoretical work. Thus I have sought to develop an experiment for the laboratory generation and detection of HFGWs. When such an experiment is successfully completed my concentration will be on the practical applications of HFGWs.

AAG: Who are some of the other key scientists involved with HFGW research?

Baker: In the United States we have Eric Davis, Dave Froning, Nick Gorkavyi, Melvin Lewis, Paul Murad, Hal Puthoff, Garry Stephenson, Clive Woods and a few others. In Europe we have Andrea Chincarini, Giorgio Fontana, Gianluca Gemme and Richard Ingley. In Russia we have Leonid Grishchuk and Valentin Rudenko.

The biggest contingent of key scientists interested in HFGWs is to be found in China. They include Fangyu Li, Chongqing University, Ruxin Li, Vice Director of the Shanghai Institute of Optics and Fine Mechanic, Jun Luo, Head of the Gravitational Laboratory of Huazhong University of Science and Technology, Dong-Ping Shi, Chongqing University, Meng-Xi Tang, Chongqing University, Yi-Chuan Li, Chongqing University, Jin Li, Chongqing University, Wen Weijia (fractal membranes) Hong Kong University of Science and Technology, Nan Yang, Chongqing University, Fang Zhenyun, Dean of Graduate School, Director of the Institute of Theoretical Physics, Chongqing University and Chen Zhenya, Post Graduate student preparing for a PhD in HFGWs at Chongqing University.



Lasers: This Chinese Ultra-High-Intensity Laser can be utilized for HFGW-generation.

AAG: Can you tell us a bit about the role of the 2003 Mitre HFGW conference, and what made this conference so interesting?

Baker: The MITRE conference was a crucial first step in bringing scientists together to discuss HFGWs from both the perspectives of theoretical Physicists and practical Engineers and included scientists from all over the world. Interestingly though, the scientists from China who did not attend (both SARS and 911 Visa constraints kept them away) became the most interested in promoting HFGW research and use the MITRE papers as background for their continued research.

AAG: Did the goals of the Mitre conference evolve into the STAIF Section-F Conference, and what makes STAIF special?

Baker: Yes, there has been an evolution of the MITRE Conference to STAIF and this was due entirely to the tireless efforts of Paul Murad and Tony Robertson. STAIF is special because it has proved to be an excellent forum for the presentation and discussion of new concept in gravitational science.

AAG: Speaking of propulsion, I've heard that High-Frequency Gravitational Waves may be self-rectifying based on the properties of space itself. Can you tell us about this concept, and what it might mean for propulsion applications?

Baker: Self-rectification in the context of gravitational waves is known as the Chirstodoulou Effect or GW-Memory Effect, but it's not necessarily associated with high-frequency GW's.

AAG: Does the work in HFGW research relate to the ongoing projects involving low-frequency gravitational wave detection to measure cosmic events such as gravitational perturbations in binary star-systems?

Baker: After many years of refinements, the first phase of the Laser Interferometer Gravitational-Wave Observatory (LIGO) has been completed at a cost of about half a billion dollars. It has reached its promised sensitivity and LIGO's laser chambers will monitor the sky's during most of 2006 – with a smaller facility in Germany, called GEO-600, joining the network later in the year. If two neutron stars (binary star system) merge within 50 million light years or so of the Earth, then the devices could detect the death spiral. It should be recognized that these detectors are totally unrelated to HFGWs and have no possibility of detecting them. Low-Frequency Gravitational Wave (LFGW) technology is as different from High-Frequency Gravitational Wave (HFGW) technology as electric-motor technology is different from microwave-electronic technology!



LIGO: A massive mainstream effort to detect the low-frequency counterpart to HFGWs.

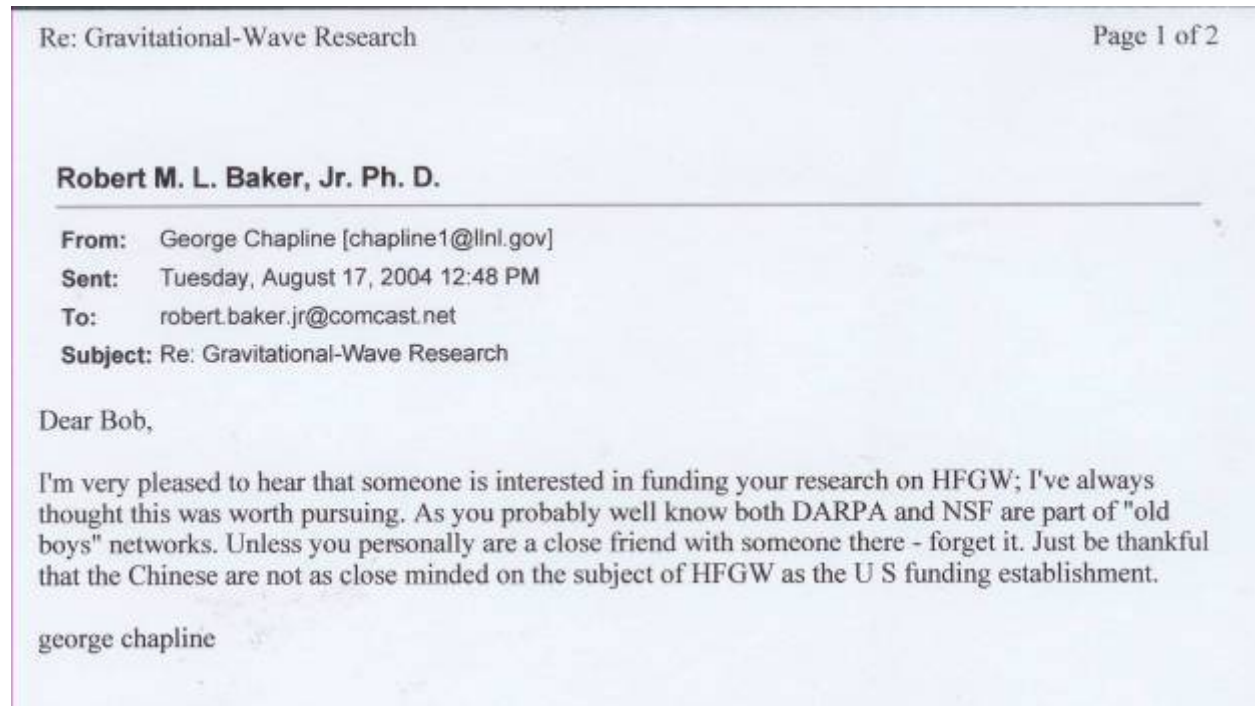
AAG: What kind of money is going into the LFGW research versus HFGW research, and why is the disparity so large between funding in the two disciplines? Also, how much funding is required to really make a difference?

Baker: This is an extremely interesting question. As just mentioned about half a billion dollars has been expended on LIGO in the US, mainly from the National Science Foundation, and probably a total of over a billion dollars when the costs of the world-wide LFGW effort is included. There are hundreds of scientists worldwide that are essentially on the “LIGO payroll” and the project is very mainstream.

There is NO funding for HFGW research except for China. Why the disparity? First, HFGW is not considered mainstream by many influential scientists. Second, human nature being what it is, there is probably an inclination for scientists working on LIGO to view HFGW research as an

unwanted diversion from their research and might siphon money (say, 10 to 20 Million) away from the LIGO effort. This is especially true since they are now promoting a space-based version of LIGO – the Laser Interferometer Space Antenna or LISA. LIGO scientists and engineers hope to launch LISA in 2015, probably at a cost exceeding that of LIGO itself. Third, there is a “Not Invented Here” or NIH principal at work.

Very pertinent to your question is the following E-mail sent to me sent by Dr. George Chapline the senior physicist at the Lawrence Livermore National Laboratory, USA. He was Edward Teller’s Principal Assistant in developing the Hydrogen Bomb.



AAG: Back to applications, how might HFGW technology play a role in communications, and why is the military interested in this aspect of it?

Baker: First of all our military is NOT interested in HFGWs. Nevertheless there are military communications applications, such as high-bandwidth communications to deeply submerged submarines and uninterrupted and secure global communications (HFGW communications go right through the Earth without the need for fiber-optic cables, satellite or microwave relays, or any other infrastructure).

AAG: What about propulsion -- do you foresee the possiblity of scaling this technology to real propulsive capacity, and if so, what are some of the strategies to attain real thrust?

Baker: HFGWs are probably not an efficient way to propel a vehicle by action-reaction like conventional propulsion systems – generation of extremely forceful amounts of HFGWs is unlikely. On the other hand the modification of a gravitational field is possible according to Landau and Lifshitz. There is a strong relationship between gravity modification and High-Frequency Gravitational Waves (HFGWs as defined as having frequencies greater than 100kHz by Hawking, S.W. and Israel, W. General Relativity: An Einstein Centenary Survey, Cambridge University Press, Cambridge, 1979, p.98). Perhaps the most cogent expression of the

relationship is given in the well respect and internationally recognized authoritative treatise by L. D. Landau and E. M. Lifshitz (The Classical Theory of Fields, Fourth Revised English Edition, Pergamon Press, 1975, p. 349). They state: "Since it has definite energy, the gravitational wave is itself the source of some additional gravitational field... its field is a second-order effect ... *But in the case of high-frequency gravitational waves the effect is significantly strengthened ...*" (emphasis added). Thus it is possible to change the gravitational field near an object by means of HFGWs and move it.

AAG: Didn't Dr. Ning Li make some interesting predictions about high-power HFGW generators? Is her work potentially related to Dr. Eugene Podkletnov's "impulse generator" claims?

Baker: To be completely frank with you it was very difficult to interpret what Ning Li was presenting. I understand that she is a brilliant scientist, but not a good communicator.

AAG: Any thoughts that the military might try to weaponize HFGW? Any worries that somebody else's military might try the same thing? Would an HFGW weapon be unique enough to be worth the development effort?



AC-Gravity, LLC: Dr. Ning Li's Type-II superconductor research may produce powerful HFGW output effects.

Baker: Certainly if one could generate remotely a very high HFGW flux and attendant large GW amplitude, even in a very small volume of space, then there might occur a nuclear reaction. Such a reaction, remotely engendered, could have far-reaching ramifications – from nuclear-waste-free energy sources to a matter-disintegrator or gravity-disruptor weapons. The more interesting military application and more relevant to our war on terror is the possibility that HFGWs could be utilized like an X-ray. It may be possible to image in 3D the interiors of buildings, locate underground roadside bombs, view deeply buried weapons of mass destruction and nuclear weapon storage and assembly facilities, etc. These are certainly long shots, but Confucius would probably say: "If the bet is to buy one of one thousand one-dollar tickets for a one million dollar prize, then make the 1000 to 1 bet."

AAG: I understand that you took a trip to China last year, and were surprised by the amount of international interest in HFGW research. Can you tell us a bit about their efforts, and how many people have become involved in their research projects?

Baker: Yes, the Chinese sponsored me on a month-long lecture tour of Universities and Institutes in China on the subject of HFGWs. As I indicated in answering Question 7, there are probably more scientists in China working on HFGW research than in the whole of the rest of the world. As far as their research plans are concerned you can find an outline of their HFGW Project at the GRAVWAVE.com website.

AAG: Is the lack of a larger effort in the USA related to a dearth of funding for this research? Have you been approached by any investors -- either foreign or domestic -- about potentially conducting experimental work to validate the concepts in your HFGW theories?

Baker: There have been some inquiries by US venture capitalists, but nothing I would call serious. It would require \$10- to \$20-million dollars for a proof of concept HFGW generator/detector project to be successfully completed and then implementing the applications would require more funding.

AAG: Can you make any predictions for the future of HFGW research?

Baker: The basic concept of generating HFGWs has been checked and rechecked by many scientists including several peer-reviewed published articles. The theory is sound. Likewise the Chongqing University detector's theory has been thoroughly examined and vetted. I predict that within the next five years the Chinese will have successfully accomplished the laboratory generation and detection of HFGWs and, as they say, "We will be off to the races!"



NASA Efforts: A gravitational-wave detection apparatus at the NASA Gravity-Research Center.

Dr. Robert Baker is one of the world's leading physicists in High-Frequency Gravitational Wave research. His remarkable theoretical work and experimental predictions are turning heads at the highest-levels in the global scientific community. His extensive credentials and remarkable scientific research are online at www.GravWave.com, or his personal site at www.drrobertbaker.com.