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# Behind the scenes of the 1957 Chapel Hill Conference on the role of gravitation in physics

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## Abstract

This brief paper will peel back some of the layers of the Chapel Hill conference, to look at its somewhat surprising origins in private philanthropy, motivated by the promise of new technologies based on anti-gravity or gravity control. We are fortunate to have a very full historical record of the conference and the so-called *Institute of Field Physics* that hosted it — the account I present here is a highly abridged version of the more detailed accounts given in Kaiser and Rickles (2018) and Rickles (forthcoming).

## Introduction

The *Conference on the Role of Gravitation in Physics*, held in Chapel Hill, North Carolina in 1957, was a pivotal event in the history of gravitational physics.[1] Not only did it establish the reality of gravitational radiation and provoke the experimental search for gravitational waves, after years of controversy (only just successfully brought to fruition, with LIGO), it also founded the subject of quantum gravity as an important field in its own right (here lies my own primary interest in the conference), amongst many other important advances and clarifications. The conference still inspires a younger generation, with recent proposals to realise experimental work on quantum gravity, once thought impossible to bring into reality, some directly based on the thought experiments presented at Chapel Hill by Richard Feynman.[2]

## Stranger than fiction

Before the Chapel Hill conference, with a few exceptions, general relativity and gravitational physics was in a state of neglect (this was acknowledged at the time). Indeed, Peter Bergmann (one of Einstein's research assistants) famously said that in these days "you only had to know what your six best friends were doing to know what was going on in general relativity" (cited in Pais, 1983, p. 268). That is not such an exaggeration. Gravity was associated in the minds of the public, military, and industry with something bizarre and magical. The level of knowledge was such that, even amongst those with scientific and engineering backgrounds, it was a common expectation that gravity could be controlled like electromagnetism. This electromagnetic analogy led to people expecting that gravity could be shielded, absorbed, and manipulated to produce novel kinds of flying machine. Ironically this very naivety about the nature of

1 The report from the conference can be found online: http://www.edition-open-sources.org/sources/5/index.html (Rickles and DeWitt, eds., 2011).

2 See for example Marletto and Vedral (2017), and Hansson and Francois, (2017).

gravity led to unusual forms of funding that would not otherwise have manifested. This funding was just enough to raise the study of gravity high enough to secure funding through more standard channels.

For example, Roger Babson, a wealthy financier with a Newton fetish, fully believed in such fantastic gravitational possibilities, motivated partially by his viewing gravity as responsible for the death by drowning of two of his relatives and in part by his friend Thomas Edison's own ideas on the subject (which seem to have been inspired by H. G. Wells' fictional work). Babson was persuaded by Edison to found an institute focused on gravity: the Gravity Research Foundation. While not pursuing research 'in house,' it would aid other researchers in their efforts, with one condition: such efforts must focus on anti-gravity. In addition to amassing the most complete collection of existing documents on gravity, the main contribution was to establish an essay competition — which still exists and receives entries from the finest physicists, including Stephen Hawking and several Nobel laureates.

This competition marks the inauspicious origins of the Chapel Hill conference. Given the lucrative $1000 prize money, Bryce DeWitt, then a young and frustrated physicist forced, by the lack of interest in gravity, to pursue it only as a hobby, decided to enter, writing his essay ("New Directions in the Theory of Gravitation") in an evening.[3] The essay satisfied the foundation's condition that anti-gravity be mentioned only by debunking the whole idea from the perspective of general relativity: there can be no anti-gravity because there aren't positive and negative charges as in electromagnetism. The whole project was, DeWitt claimed "a waste of time."

However, DeWitt dangled a carrot in front of the gravity research foundation: while general relativity might be an anti-gravitational dead-end, *quantum gravity* (his chosen field) might lead to extensions that increased the physical possibilities. Given such tantalizing claims from genuine experts, one can hardly be surprised that less knowledgeable folk might look forward to the day when anti-gravity becomes a reality. Knowledge was too incomplete at that stage and the reason for this, says DeWitt, is that there simply was no funding or support for gravity researchers: progress demands "external stimuli". That caught the attention of the foundation's vice-president (and the essay competition's overseer) George Rideout. Rideout was well-connected to a range of people that might offer up support in search for their holy grail: anti-gravity. This including those in industry and also those with military links, keen to militarize gravity as had occurred with atomic power. Rideout sent DeWitt's paper to several of these pointing out the request for support.

Hence, the poor state of knowledge contributing to the funding of study of general relativity and gravity, thereby providing a springboard from which to propel itself into an area where it received the more orthodox funding and support many other areas of physics were receiving. Respectable physicists had their own grails to search for at the time, including curing some of the problems with elementary particle phys-

3 Interview of Bryce DeWitt and Cecile DeWitt-Morette by Kenneth W. Ford on 1995 February 28, Niels Bohr Library & Archives, American Institute of Physics: https://www.aip.org/history-programs/niels-bohr-library/oral-histories/23199

ics, then facing its own difficulties. It was further hoped that gravity might offer up some clues and that the two might assist one another. The idea of progress through the mingling of gravity and particle physics was further bolstered by the subsequent year's winning entry, by two postdocs at the Institute for Advanced Study, Dick Arnowitt and Stanley Deser (both students of Julian Schwinger, at Harvard, like DeWitt was). However, their paper was a hoax: they hadn't expected to win, and their supervisor, Robert Oppenheimer, was not impressed. Less knowledgeable folk were impressed, especially by the idea expressed in the paper that gravity could be converted into nuclear energy. This hoax paper would attract the attention of military and industrial funding sources, as well as others on George Rideout's radar. Combined with DeWitt's call for action, it provided perfect conditions.

One of these was Agnew Bahnson, owner of a North Carolinian air conditioning manufacturing company and an amateur engineer with an interest in gravity. He was also a pilot and, later, author of a science fiction novel, *The Stars are too High* (New York: Bantam, 1959), describing how a group of brash engineers discover how to harness the power of gravity to build a flying saucer with which they dominate the world! Bahnson genuinely wanted to bring his dream to reality. He approached DeWitt with his vision, albeit tamed with an offer of a university affiliation, with his alma mater the University of North Carolina. DeWitt ignored it, reckoning Bahnson as just another of gravity's many cranks. However, Bahnson was close friends with head of physics at the University of North Carolina, who was himself close friends with the influential physicist John Wheeler, himself recently converted to the study of gravitation (see Rickles, forthcoming B). Wheeler intervened, suggesting DeWitt give serious consideration to the offer, especially in the light of the serious lack of funding in he field of gravitational physics, as DeWitt himself admitted in his competition essay. Bahnson contacted DeWitt again, with lucrative terms including no administrative or teaching duties, and this time DeWitt bit. The result was an unlikely yet enormously fruitful partnership between an enthusiastic but untrained heir of an engineering plant and arguably the most formalistic, number crunching quantum gravity theorist around, that would transform the face of gravitational physics. Bahnson's support led to the creation of the first institute devoted to the study of gravitation (The Institute for Field Physics) whose inaugural conference is without a doubt the most important in the history of gravitational physics. More importantly, it established new research networks and expanded the range of funding available to those working in the field.

### Institute for Field Physics, Inc.

The Institute for Field Physics was officially incorporated on September 7th, 1955. With its stated aim to become *the* international centre for activity in gravitational physics. A fairly large part of the early phases of the institute was shrewdly devoted to distancing itself from the more fanciful side of gravity — especially the kinds of anti-gravity interests pursued by Bahnson himself. This ultimately resulted in a "protection clause" that would accompany any publicity related to the institute pointing out that any work carried out there has nothing to do with anti-gravity and is based on the Newton-Einstein analysis. In fact, Bahnson continued

to pursue his dream of anti-gravity (based on the idea of "electrogravitics:" achieving lift through strong electromagnetic fields) with a collaborator, T. T. Brown, while continuing to bankroll the Institute for Field Physics, with its firmly expressed dismissal of such research. He would often rope in DeWitt himself, as well as other notable physicists such as Edward Teller, to assess his experimental work, only to be disheartened by their reactions each time.

Despite his unscientific leanings, Bahnson was an incredibly active fundraiser, and kept donors fully informed of the institute's activities through regular 'memoranda' (a wonderful resource for historians). His connections extended into aviation, computing, and the military, and he was able to pull in founders memberships from a great many sources, including IBM (which also provided computing time for some of the first gravitational simulations), General Dynamics, Glenn Martin, Sikorsky Helicopter, and more. The DeWitts (Bryce and his mathematical physicist wife Cecile) joined the fund raising efforts, securing substantial support from the NSF, the Air Force, the Navy, and beyond. As mentioned, it seems fairly clear that some idea that there might be practical applications motivated much of this funding. Coming on the back of the atomic and hydrogen bombs, the power of physics must have been somewhat humbling for the military agencies.

## The Chapel Hill Conference

Support was primarily requested for the conference, which was one of the central aims of the institute, to set the agenda for future research. The first mention of the conference was in November 1955, shortly after incorporation. Originally proposed for June 1956, this date would be taken up by an earlier meeting at Bahnson's summer house in Roaring Gap, with a few select figures, including potential funders and media people — Freeman Dyson and George Rideout (of the Gravity Research Foundation) were also present.

The initial list of invitee suggestions included various notable physicists that didn't make it to the final event, including Wolfgang Pauli, Niels Bohr, and Rudolph Peierls. A later list included Vladimir Fock, Kurt Godel and George Gamov, also absent from the final event. Still, Richard Feynman, Peter Bergmann, Freeman Dyson, John Wheeler, Leon Rosenfeld (after some Cold War complications were dealt with), and others made it. In fact, 11 nations were represented. There were in fact Cold War complications with several of the speakers from behind the Iron Curtain at the time. It was also at this conference that plans for a series of future general relativity and gravitation conferences was made, by Andre Lichnerowicz and others. This led to an international community of gravity researchers, so crucial for the development of the field (see Lalli, 2017, for an excellent recent account of the creation of the community). Without the bizarre, serendipitous confluence of ignorance about gravity, wealthy gravity aficionados, post-war scientific conditions (established by the creation of the atom bomb), and desperate gravity experts in search of funds, it is clear that gravitational research (LIGO very much included[4]) would have been set back by decades.

4 The first firm establishment of the reality of gravitational radiation along with ideas for their detection came directly from the Institute of Field Physics' conference.

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