

John A. Wheeler & Astrophysical Relativity

Charles W Misner
University of Maryland

or

John A Wheeler
and the recertification
of GR as true physics

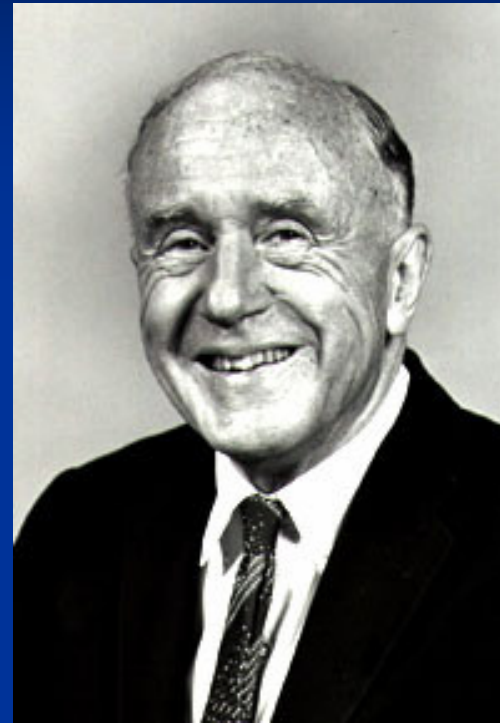
J A Wheeler phases

- Particles/nuclear 1933-1955
- Fields/general relativity 1953-1977
- Information/“It from bit” 1977--

Wheeler timeline

- Born 9 July 1911
- Ph.D. Johns Hopkins (Herzfeld) 1933
- Bohr Institute 1934-35
- Married Janette Hegner 10 June 1935
- Asst. Prof. Princeton 1938
- Bohr-Wheeler nuclear fission paper 1939
- A-bomb, Hanford Washington 1942-45
- H-bomb 1950-1952
- Moved to Austin, Texas, 1976
- Retired from Texas 1986

**2003 Einstein Prize
to
John A. Wheeler
*Princeton University
(retired)***



Wheeler the Teacher

- Teaching to learn
- Inspiration first
- Enthusiasm from current research
- Questions trump answers
- Students produce physics

FAMILY GATHERING

*Students & collaborators
of John Archibald Wheeler
gather some recollections of their work with him,
and of his influence on them*

The '30's and '40's

Aage Bohr

Katharine Way

Henry H. Barschall

Richard P. Feynman

Mael A. Melvin

Gilbert N. Plass

Arthur S. Wightman

The '50's

David Lawrence Hill

Lawrence Wilets

John Toll

Kenneth W. Ford

Richard Bellman

William Grasberger

David M. Chase

James J. Griffin

Arthur Komar

Marjory Pratt

Joseph Weber

Tullio Regge

Thomas O. Philips

Charles W. Misner

Robert Marzke

Daniel Sperber

Raymond C. Mjolsness

Dieter Brill

Robert N. Euwema

B. Kent Harrison

John R. Klauder

John G. Fletcher

Peter Putnam

James B. Hartle

The '60's

David H. Sharp

Georgia S. Witt

Kuk Pyo Chung

Robert Fuller

Masami Wakano

Allen Mills

R. Bruce Partridge

F. Bary Malik

Karel Kuchar

James W. York, Jr.

Richard Lindquist

Fred K. Manasse

Edward Redish

Heinrich Leutwyler

Andris Suna

Cheuk-Yin Wong

George H. Brigman

Lawrence C. Shepley

Kip S. Thorne

Hans Ohanian

J. Peter Vajk

Alfonso Campolattaro

David William Meltzer

Edwin F. Taylor

Anthony Zee

Roger Penrose

Michael D. Stern

Paul Boynton

Ulrich H. Gerlach

Robert Geroch

Arthur E. Fischer

Jeffrey M. Cohen

The '70's

Brendan B. Godfrey

Clifford E. Rhoades, Jr.

Jeffrey M. Greif

Demetrios Christodoulou

Remo Ruffini

Leonard Parker

Terrence J. Sejnowski

Robert Wald

Jacob D. Bekenstein

Bahram Mashhoon

Yavuz Nutku

James Isenberg

Claudio Teitelboim

Eckehard Mielke

Orlando Alvarez

Charles Patton

Dragoljub Cetkovic

John A. Wyler

Lawrence Ford

G. David Kerlick

Friedrich Hehl

Adam Burrows

Larry Smarr

Daniel Rohrlich

Gary Glenn Miller

Gary Horowitz

LETTERS ARRIVING AFTER JULY 1

J. Dempster

Bei-Lok Hu

Alan T. Kellogg

Fernando Lund

Herman N. Parker

Joel Primack

James Ritter

J. Fred Singer

F. G. Werner

Frank Zerilli

Sergio Hojman

W. G. Unruh

S. Fred Singer

My PhD thesis defense in 1948 will always remain in my memory. You had arranged a prestigious committee, including Oppenheimer and Niels Bohr. I started to explain my work, Oppie interjected, took over, and held the floor. I sat down while he continued, Bohr fell asleep, and you looked vaguely unhappy. I passed the exam.

Tullio Regge

itable. After that conversation, which stirred my interests in general relativity and buried the conformal group, I thought that you had forgotten me and that I had to remain one of the many casual acquaintances one makes at conferences. One month later I received an invitation to join you at Leiden. I was penniless; a grant from the "Friends of Princeton" allowed me to reach Holland from Italy and to start work on the stability of the Schwarzschild singularity. You handed me a form, or rather, the paper already written but without formulas. Sometimes I find it hard to explain to people who do not know you that this was not a form of repressive action but instead the opening of an entirely new and exciting activity from which I derived endless intellectual pleasure. It was also the beginning of a collaboration which brought me to Princeton and changed my life. Af-

Raymond Mjolsness

I would like to single out one of your actions, which turned out to be the most helpful thing that anybody ever contributed to my education. I was given your then current scientific notebook to retain for a period of two days or so. This made it possible for me to see for the first time precisely how a mature scientist of outstanding talents goes about organizing a large scale research program in a basic scientific field along lines that were virtually unworked by anyone else. In short, you showed the way toward precisely that which all but the very few students find impossible to develop quickly at that stage of their careers; a global view of their subject, the balance of strategy and tactics necessary to develop the view and an illustration of the methods by which it is possible to mount research efforts along essentially all the promising pressure points of the frontier of the subject.

Bob Euwema

him. The one saying of Professor Wheeler that I quote more than any other to my coworkers is 'An expert is one who has made every mistake in some field.' It is amazing how often this is appropriate."

Barry Malik

A perfect legacy of Bohr and Einstein. A firm believer in the simplicity and the universality of physics ("Never do a complicated calculation unless you know the answer" or "If one really understands a phenomenon, one can build a simple model and explain to anybody"). A radical conservative, ready to recognize new ideas but only after examining the old one carefully. A worthy carrier of the Bohrian tradition of being

A great devotee to science but never failing to recognize the greater truth, so vividly described by the medieval Bengali poet "Chandidas"

অসার উপরে মানুষ অস্ত্য

(Above everything lies the humanity). A great believer and true practitioner of democracy, human rights and decency,

Kip Thorne

Style of writing: Nobody else in science writes quite like you, Johnny! (Or almost nobody else. One of my most memorable moments was several years ago when a delegation of my students came to me, MFW in hand, to complain that a certain section was too "Wheeleristic". Why had I permitted it to go through without toning down? With glee I told them "Wheeler did not write that section; I wrote it!") Your style -- elegant and crystal clear, with twists of amazement and amusement; poetry in the midst of prose; the pithy phrase pregnant with insight; parenthetical allusions to whole bodies of knowledge which the reader might have encountered elsewhere; argument by analogy and paradox -- it is a style that creates enthusiasm in some; revulsion in others. But even in those

J. Peter Vajk

precepts you taught and exemplified so well. My work has shifted far from general relativity theory, but one idea you repeated frequently has always been a reliable and valuable guide:

Finding the right answer is never as important as asking the right question.

James W. York, Jr.

me to apply for a place at the Battelle Rencontres to be held in the summer of 1967. However, I was sure I had little or no chance of receiving an invitation to attend. That I did attend must surely be credited to your having persuaded the admission committee to take a gamble on an unknown man from a university not noted for theoretical physics! It is a great credit to you as a person who has shaped many careers in theoretical physics that you have always given an equal chance to anyone who shows promise, regardless of the person's "credentials".

Demetrios Christodoulou

Dear Professor Wheeler,

I take this opportunity to express to you my deepest gratitude, for all you have done to enable me to become a scientist at an early age, and for teaching me to question, to think and to understand. I do not know what I would have been if I had not met you that day on January 1968 in Paris. Certainly, I would be much poorer in the gifts of mind and spirit.

Remo Ruffini

While at Princeton Ruffini has collaborated in publications with: R. Breuer (Univ. of Wurzburg W. Germany), T. Damour (observ. de Meudon, France), G. Denardo (I.C. T.P., Trieste), A. Ferrari (Univ. of Torino, Italy), R. Giacconi (Harvard Univ. Cambridge Mass.), H. Gursky (Harvard Univ. Cambridge Mass.), H. Ohanian (Union College, Schenectady, N.Y.), L. Parker (Univ. of Wisconsin, Milwaukee), R. Partridge (Haverford College - Pennsylvania), M. Rees (Univ. of Cambridge, England), J.A. Wheeler (Princeton University, N.J.), J. Tiomno (Univ. pontificia, Brazil), A. Treves (University of Milano, Italy), V.C. Vishveshwara (New York University, N.Y.), H. Sato (Yukawa Hall, Kyoto Japan), J. Wilson (Lawrence Lab., Livermore Calif.), F. Zerilli (University of Michigan, E. Lansing).

Robert Wald

Perhaps the most valuable lesson you helped teach me (mainly by your example) was to think about physics in a very direct, physical manner while at the same time utilizing abstract mathematics to the fullest extent. One should always think in a completely down-to-earth manner and decide by physical intuition what ought to be true; then one should obtain a mathematical proof (or disproof) of one's physical conjecture. The first step alone is likely to result in cloudy guesswork; the second step alone may lead only to uninteresting, technical mathematics. But the right combination, as your example shows, can lead to inspiring physics. I will be very satis-

Sergio Hojman

When I was an undergraduate student I was always taught physics as a subject that was developed "a long time ago, somewhere else, by someone else". It was not until after I made your acquaintance that I realized that physics could be developed "now, here, and by us" and I think that this is perhaps the one thing I am most grateful to you for.

Jim Isenberg

the beach where grandson "Wheeler" was playing. (We were at the High Island summer home.) Suddenly John wrote across the top of the page, in large block letters:

"DESLUDGE"

At the time, I had no idea what to make of this strange collection of letters.

Teaching has always been a most important enterprise to John Wheeler [How many full professors want to teach the basic college physics courses, and want to write introductory physics texts?]. And "desludged" teaching is the only kind he does. So it is with the members of the clan. Indeed, one of the clearest

Claudio Teitelboim

When I arrived in Princeton I found you always reachable, patient, gentle and encouraging. I recall being ashamed about the enormous amount of time you spent going over my first paper, correcting my English (your answer was "That is what I am paid for") and being inflexible about obscure passages, but always with a sense of humor ("the central idea should always stand out clearly, sharply, just as in 'Cuba si, Yankees no'"). I also became soon

John A. Wyler

Dear John:

What clearer evidence of my own scientific debt to you could there be, than that contained in my paper "Rasputin, Science and the Transfiguration of Destiny" (Gen. Rel. Grav. 5, 175 (1974))?

I have before me your kind letter of September 1, 1974, expressing appreciation of my small effort. No greater influence, no more important inspiration, no more constant source of ideas, than your own, has any other teacher had on my writings. My existence, indeed, is no less a figment of your conception than of any other. How reasonable to suppose that this influence resulted from a long period of collaboration and association. And yet, nothing could be farther from the truth. There stands out in mind with startling

William H. Press

With every good wish,

A handwritten signature in cursive script, reading "John A. Wyler". The signature is written in dark ink on a white background.

John Archibald Wyler

(dictated in Dr. Wyler's
absence, proofread and
signed by GWS in his
presence)

Larry Smarr

steady hand I needed. You invited me to Princeton for a month to finish up my work on the shape of a Kerr black hole before I went to Europe. Princeton! What a magic place it was then: Wald, Bekenstein, York, Kuchar, Davis, Cohen, Hu, Mashoon, Ford, Kerlick, Christodoulou, Ruffini, and more. Many of these people were to become great friends of mine. But most importantly, I really felt a part of a scientific revolution--the birth of the black hole.

John A Wheeler and the recertification of GR as true physics

GR 1927--1950

- 1927—1933 Cosmology: Lemaitre, de Sitter, Hubble, Einstein
- Einstein-Infeld-Hoffmann 1938, Einstein & Straus 1945
- Unified Field theories (mostly weak maths)
- Lichnerowicz, Landau & Lifshitz, Bergmann, Infeld, Synge [see Kennefick history]

Bad Karma

- Caltech professor to Kip Thorne as Kip departs for Princeton: GR has little relevance ... look elsewhere for interesting physics.
- Novikov's wife given advice: relativity is a backwater ... Ivor should leave it.

[KST p268]

Post WWII GR leaders

- Wheeler
- Sciama
- Zeldovich
- Bondi
- Choquet-Bruhat
- Schild
- DeWitt

Wheeler 1950s

- “Mass without Mass” – Geons
field energy can be confined by gravity
massive objects don't need particles
nonlinear GR does new things
- “Charge without Charge” – wormholes,
topology, lead to Finkelstein & Beckedorff
geometrical views of “Schwarzschild singularity”
- Brill wave initial conditions

JAW 1950s theme

- “Dynamic conservatism”:
- Explore the equations of physics for what they have to say.
- Don’t just ask them for details about things you’ve already seen.

Wheeler 1950s

- Encouraged Weber's wave detectors
- Regge-Wheeler perturbations of Schwarzschild
- Sciama, Penrose visit Princeton

New Experiments

- Pound Rebke 1959 redshift
- Dicke experimental gravity group formed

Wheeler early 1960s

- Collapse to a singularity must be impossible
(Note this brings accepted physics, nuclear forces, into the GR picture)
- Finkelstein, Beckedorff-Misner, Kruskal give a picture of collapse
- Brill-Hartle: gravitational waves have energy
- Hahn-Lindquist: numerical relativity 1963

Gravitational Expansion 1963-1977

- Princeton group expands: Thorne, York, Bekenstein, Ruffini
- Sciama, Misner, Schild, Thorne, Infeld, Chandrasekhar, Hawking, Newman, ... build research groups
- “Texas” meetings, quasars, pulsars, Weber claims, Kerr metric, singularity Theorems, “no hair” theorems, BH Thermodynamics

References

- Wheeler/Ford, “Geons, Black Holes, ...” (Norton 1998)
- Thorne, “Black Holes, ...”, (Norton 1994)
- Anon., ed., “Family Gathering”, 2 vol. (privately distributed 1977: AIP, Princeton, Texas)
- Bartusiak, “Einstein’s Unfinished Symphony” (J Henry Press 2000)
- Kennefick, “... Gravitational Waves” (Princeton U Pr 2007?)