

DOUGLAS FAMILY

AHLE U. DOUGLAS

Eddington Biography - Reviews

SUBJECT FILES

1956-1981

DOUGLAS FAMILY

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Yours uncerely

A. S. Eddington

hypothesis that the energy levels ϵ or (more directly) the emitted frequencies increase with time has no meaning unless you define the standard of energy, ^{or time} which you take to be constant. As I have no idea where this standard is to come from, the theory you propose conveys nothing to me. So far as I can see you are just making a relativity transformation $t' = f(t)$ of the coordinate t ; and the reason why you appear to get observable effects is that you do not carry out the transformation far enough to verify that the effects cancel. At any rate if you do introduce a new time-rectifying t' defined by some

We get on pretty well here though things are a bit difficult in various ways. One misses very much the stimulus of research students; even third-year students are very scarce.

With kind regards and good wishes for Christmas

Yours sincerely

A. S. Eddington

The Times Literary Supplement

"A very complete record of the most modest of all scientific luminaries of the age".

The Manchester Guardian (Professor Herbert Dingle, University of London).

"Dr. Douglas is to be congratulated on success in this very difficult task. The scientific work is described in a manner which though inevitably not fully understandable to the general reader, yet leaves him enlightened and not bemused ... Memorable scenes are faithfully and excitingly presented ... no one who is interested in the wider aspects of science and its philosophy, whether or not he is expert in the subjects with which Eddington was most concerned will fail to find stimulation and enlightenment from this account of one of the great original spirits of our age."

The New Scientist (Professor F.J.H. Stratton, F.R.S. Cambridge).

"It can have been no easy task to make an interesting story of the unspectacular life of Eddington whose 'work was his life while his life was his work'. But Dr. Douglas has successfully done so ... a full account of the many battles with Jeans and later Milne, where little quarter was given in the battle of thrust and parry ... a full account of Eddington's work on relativity..."

The Glasgow Herald

"A careful study of his life and literary remains ... a good account of Eddington's scientific work explaining its methods and achievements in a convincing way without going into the technical details ... will be enjoyed both by those with a professional interest in Eddington's work and by members of the wider public ..."

The Friend (Howard Diamond)

"Those of us who know Arthur Stanley Eddington give thanks for our remembrance of him and redouble our thanks to Dr. Douglas for the very faithful and understanding picture ... given in this book."

Nature (L.A. Pars, Cambridge)

"The author of this excellent book ... has achieved a nice balance between the story of the man and the story of his scientific work ... described in such a way that it makes it not too inaccessible to the general reader ..."

The Scotsman

"Eddington's work was, of course, his life and the author ... had to be equipped with knowledge, understanding, literary skill and an appreciation of the man in

the astronomer. Eddington has indeed been very fortunate in his biographer, who does not fall short in any way."

Queen's Quarterly (Dr. C.S. Beals F.R.S., Dominion Astronomer).

"A book packed with information which no one interested in the history of science should miss reading."

Endeavour, London (Sir H. Spencer Jones).

"Dr. Vibert Douglas has succeeded admirably in her account of the life, the scientific work, and the philosophy of a man who was quiet, reserved, and undemonstrative, and who never sought the limelight. An excellent account is given of the course of Eddington's scientific work on stellar movements, stellar structure, and stellar physics, on relativity, and on fundamental theory."

Discovery (G.A. Ronan)

"It is perhaps a vain hope to expect that every great leader of scientific thought should have so excellent a biography prepared as Miss Douglas has done for the late Sir Arthur Eddington ... this is a first-class book ... it can be strongly recommended to all interested in modern astronomy, the universe, and relativity, as well also to those who would like to know something of the life, outlook and work of one of the scientific giants of the 20th century."

Archives Internationales d'Histoire des Sciences (Dr. N. E. Slater)

"... a portrait extraordinarily well rounded of such an elusive personality."

"... the course of Eddington's work is fully described (no mathematical formulae are employed, but a general acquaintance with physics is assumed), and closely related with his life, his scientific travels, contacts and controversies. ... this biography brings together so much enlightenment on the development of Eddington's scientific and philosophical outlook that all students of his work will thank Dr. Douglas."

Blackfriars (Lawrence Bright, O.P.)

"This is a quietly efficient book such as Eddington would have liked. ... it is an important contribution to the task of assessing this controversial and rather enigmatic figure..."

The Observatory (Professor W.M. Smart, Regius Professor, University of Glasgow)

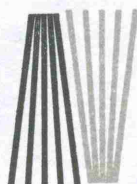
"The writing of a biography of such a man as Eddington required great courage and deep understanding of his scientific works, for his mind and pen ranged over the whole expanse of astronomy and atomic physics in a measure unequalled by any of his contemporaries. Professor Douglas has combined these qualities in a notably high degree; moreover, she reveals a literary skill befitting the eminence of the subject of her book. ... a signal service in the realms of scientific biography; her book will bring delight and profit to all classes of readers."

The Methodist Recorder (Professor C.A. Coulson F.R.S.)

"The author is well equipped to deal with the scientific aspects of Eddington's work and her account is made much more valuable by inclusion of quotations from Eddington's private diaries and letters to which she has had full access. This book is therefore likely to be the only definite account of one of the really great minds of our generation."

Sky and Telescope (T.K. Mann, Harvard College Observatory)

"... an integrated view of the activities of a truly great scientist ... a fairly general but interesting account of his early studies of star motions, through stellar structure, relativity, and cosmology ... a lively narrative of his controversies with his fellow astronomers ... a lucid outline of Eddington's personal philosophy ... No review can be complete without commenting on the literary excellence of the biography ... fascinating reading for both the professional and amateur astronomer."



Thomas Nelson & Sons Limited

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16th July 1976

Professor A. Vibert Douglas
127 King Street West
Kingston
Ontario Canada

Dear Professor Douglas

ARTHUR STANLEY EDDINGTON

Thank you for forwarding Mr Johannesson's letter of 24th June with your comments written thereon.

We should very much like to help him over the photograph from the above, but when we closed our offices in Edinburgh almost ten years ago we were obliged to discard many old records and files. Consequently, we are quite unable to say who holds the copyright to the photograph (and that is the heart of the matter), nor can we provide a print or indeed the book itself.

We are extremely sorry that there is really nothing further we can do, and it appears that we must tell Mr Johannesson of the position, disappointing though it is.

Yours sincerely
for THOMAS NELSON AND SONS LIMITED


Allan Ramsay
Rights Manager

AR:asp

YNGVI JÓHANNESSON

REYKJAVÍK
ISLAND (ICELAND)

P. O. BOX 764

Reykjavík, 24th June, 1976

Professor A. Vibert Douglas
c/o Thomas Nelson & Sons Limited
Lincoln Way Windmill Road
Sunbury-on-Thames Middlesex TW167HP
England

The Manager

Dear Sir, I think the request in this letter is in your jurisdiction, not mine. I should like to send him a copy of the photo (p. 115) but think it is your decision - you have the original - probably in Edinburgh, but could reproduce it for him from the book.
Albert Douglas

Dear Professor,

The writer has written an essay in Icelandic re some correspondence he had years ago with Professor Albert Einstein and Sir Arthur Eddington, and he should like very much, if possible, to include/said essay when printed the picture of Sir Arthur and Professor Einstein which appeared in your biography of Sir Arthur published in 1956. I regret to state that the book appears not to be available here, and I understand it has been out of print for many years.

*Kingston Del
6/6/76*

In case you should happen to possess an extra copy of the book or picture, would you perhaps do me the favour to let me have it or, alternatively, have the picture copied for me for the said purpose? I am of course prepared to pay the expenses involved. (A copy of the original photograph would presumably be best suited for the purpose).

Hoping you will kindly excuse the trouble caused,
I am,

Yours sincerely,

Yngvi Jóhannesson

Yngvi Jóhannesson

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*

NATURE, London, Eng.
January 5, 1957

EDDINGTON

The Life of Arthur Stanley Eddington
By Dr. A. Vibert Douglas. Pp. xiv 208 15 plates.
(London and New York: Thomas Nelson and Sons, Ltd., 1956.) 25s net.

It is no easy task to write a biography of a man of science, especially if the work is to attract both the specialist and the layman. The life of a scholar, centred in his study or laboratory or observatory, is on the surface unspectacular. True, there are great adventures: but they are adventures of the mind, and moreover adventures that are barely intelligible to people whose interests lie in different fields. The biographer therefore faces a difficult problem. Too much attention to historical detail, even if liberally spiced with entertaining anecdotes, will produce a book that seems insipid to the scholar. Too much insistence on the scientific discoveries will make it forbidding to the layman.

Eddington's life was outwardly uneventful. He was born in 1882. He was still an infant when his father died, and his early years were spent with his mother and sister at Weston-super-Mare. His amazing precocity was apparent even in his boyhood. Before he was sixteen he went to Owens College, Manchester, and in 1902 he went to Cambridge as a Scholar of Trinity. He took the Tripos in his second year, and was Senior Wrangler: never before had this distinction been won by a second-year man. The period from 1906 to 1913 he spent at Greenwich, as chief assistant to the Astronomer Royal. In 1913 he was elected to the Plumian chair at Cambridge, and here he remained until his death in 1944. He was knighted in 1930, and the Order of Merit was conferred on him in 1938. The even tenor of his life was varied by holidays (often in the Lake District with his life-long friend C.J.A. Trimble), excursions abroad to observe eclipses or to attend astronomical congresses, and visits to universities in all parts of the world to lecture on his researches. But if the course of his physical life was comparatively uneventful, his intellectual life was one of high adventure, full of exciting discoveries, and of pioneer voyages "through strange seas of thought alone."

Professor A. Vibert Douglas, of Queen's University, Kingston, Ontario, the author of this excellent book (which incorporates material contributed by Mr. Trimble), was formerly one of Eddington's research students. The task has clearly been a labour of love,

EDDINGTON

Prof. Douglas has achieved a nice balance between the story of the man and the story of his scientific work. The picture that emerges shows a man rather shy and retiring, but kindly and sympathetic, of immense intellectual power, completely devoted to his research, and with the quiet humour and the fairy-touch of fantasy so evident in his books. The scientific work is described in a way that makes it not too inaccessible to the general reader. Some outstanding points of the story are the early Greenwich work on star-drifts; the impact of Einstein's theory of relativity, of which Eddington was a pioneer exponent: the researches on stellar structure: the exciting moment (in 1920) when the first measurement at Mt. Wilson of the diameter of Betelgeuse verified Eddington's prediction that this star is big enough to hold the Sun and the solar system as far out as Mars: the universe: the point at which it became clear that his 'wild idea' about the dwarf stars might after all be possible - that their densities might have incredibly high values, one ton in a cubic inch: the long controversy with Jeans about radiative equilibrium: the final bold speculations about fundamental theory, left still incomplete at his death.

Eddington's life was a peculiarly happy and satisfying one. He had the felicity, denied to many men, of being able to lead just the kind of life he most desired and to achieve just the kind of things he hoped to achieve. We can justly apply to him Maurice Baring's tribute to a hero in a different sphere:

"Here is no waste,
No burning Might-have-been,
No bitter after-taste,
None to censure, none to screen,
Nothing awry, nor anything misspent;
Only content, content beyond content,
Which hath not any room for betterment".

L.A. Pars

This is given first place in Nature after the Editorial.
I have never met Pars but wrote him long ago re his fine reminiscences of Edd.
I am not as taken with Baring's verse as Mr Pars is!
Edd drew great scientific censure & was continually striving towards the unattained goal of his Fund. Th. AVD

November 29, 1956

LIFE OF A GREAT ASTRONOMER

F.J.M. Stratton

Arthur Stanley Eddington, by A. Vibert Douglas. (Thomas Nelson & Sons, 25s net.)

It can have been no easy task to make an interesting story of the unspectacular life of Sir Arthur Eddington, whose "work was his life, while his life was his work." But Dr. Vibert Douglas has successfully done so: as a former student of his she describes the effect he had on his class: "The thrill of seeing physical science on the march in a new direction, the sense of something stirring, of new adventure, held us tensely expectant even though we might but half comprehend it." And later she writes of the excitement produced at meeting after meeting of the Royal Astronomical Society when Eddington presented his classical papers on radiation pressure in stars, on the sizes of giant stars, on the mass luminosity law or on white dwarfs - all the researches leading up to the Internal Constitution of the Stars - the standard treatise on a new field of astrophysics. A full account is also given of the many battles with Jeans, and later Milne, at the Society's meetings, where little quarter was given in the battle of thrust and parry.

Eddington's training as a physicist at Manchester, as a mathematician at Cambridge and as a practical astronomer at the Royal Observatory, Greenwich, coupled with an uncanny physical intuition kept his mathematics on the right lines in his astronomical researches; they have inspired in many people confidence in the more abstruse realms of his Fundamental Theory, left incomplete as it was by his early death - an unfinished symphony.

Dr. Douglas gives a full account of Eddington's work on relativity and of the important part he played in introducing the new theory to the English-speaking world, in confirming it by eclipse observations of the bending of light in a gravitational field and in developing the theory of The Expanding Universe. As in the case of the sizes of the diameters of giant stars, we find his prediction of the displacement of the lines in the spectrum of the white dwarf Sirius B closely confirmed by observations made with the giant telescopes of California.

Throughout his writings Eddington displayed a fine literary style and a humorous outlook somewhat unexpected in one so quiet and restrained in manner. His metaphysical theories have been attacked from many sides and his

attempts to link cosmic and atomic phenomena may not have convinced many theoretical physicists; Dr. Douglas, however, points out that his theoretical calculation of 25 constants of nature does present an impressive challenge to his critics; she quotes Jeans as saying that "Some such vast synthesis may in time explain the nature of the world we live in, even though the time may not be yet."

His personal genius and intuition offer the strongest support to Eddington's theories. This may be linked with the practice of meditation ingrained in him as a lifelong member of the Society of Friends. The still, small voice which asks "what doest thou here?" ever appealed to him. In his approach to religion he displayed a quiet, unemotional sanity and balance: for him reason was one of the articles of faith.



THE GLASGOW HERALD, Glasgo.
January 7, 1957
Scientific Books of the Month

THE ACHIEVEMENT OF SIR ARTHUR EDDINGTON

The Universe and Human Thought

Arthur Stanley Eddington. By A. Vibert Douglas. 25s. Nelson.

Sir Arthur Eddington who died in 1944, received his early training as a mathematician and was Senior Wrangler in 1904. His exceptional gifts were used to the full, first in the application of mathematical techniques to astronomical problems, later in the popular exposition of scientific ideas and, towards the end of his life, in a lonely attempt to construct a fundamental theory correlating all the basic phenomena of physics and cosmology.

Professor Douglas, who was a research student in Eddington's department during the early 1920's, has made a careful study of his life and literary remains. The early years are well documented by letters and diaries, but from the later period no personal papers were left, except a meticulous record of his cycling mileages in one notebook and of his publications, their sales and receipts, in another.

This book gives a good account of Eddington's scientific work, explaining its methods and achievements in a convincing way without going too deeply into the technical details. His posthumous book on fundamental theory, and the labours which went into its composition, offer a more difficult problem. Eddington believed that various physical constants such as the mass of the electron and the speed of light, which had been found by experiment, could be calculated from first principles. They were, he asserted, dependent on the processes of human thought rather than on the material properties of the universe. These highly original ideas were developed in a mathematical theory which certainly gave the right numerical answers but had a mixed reception from observers qualified to judge it. Some dismissed the whole thing as mere juggling with numbers, others confessed that the reasoning was too difficult for them to follow, and not a few suggested that it might eventually prove to be the most important of all Eddington's contributions to knowledge.

This controversy cannot yet be resolved. The author correctly provides an impartial summary of what the experts have written and said. Professor Douglas's biography of her great teacher will be enjoyed both by those with a professional interest in Eddington's work and by members of the wider public who were introduced to the mysteries of cosmology and astronomy by those fascinating books, "The Nature of the Physical World" and "The Expanding Universe."

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REVIEW.

SCIENCE PROGRESS

OCTOBER 1957 (G. Burniston Brown.)

The Life of Arthur Stanley Eddington. by A. Vibert Douglas. (Pp. xi 207, with 15 plates.) (London, Toronto, New York: Thomas Nelson & Sons, Ltd., 1956. 25s. net.)

To give an account of 'Fundamental Theory' and of its author must be among the most formidable tasks that any human being could attempt, so that Prof. Vibert Douglas deserves congratulations from all those who knew and admired Sir Arthur Eddington for having approached so near to her goal. The present reviewer joined, as a child, in parties given by Eddington's mother, who was a lady of great charm, and the games she invented always required intelligence for success: he also used to play golf with Eddington, a process during which very curious trajectories were produced: and argue with him about dimensions in his bedroom at the hotel where he used to stay after some elderly mutual relatives had died; and once even dared to mention Jeans, for which he was rewarded with: "The trouble with Jeans is that he doesn't really understand what goes on inside a star!" This exclamation illustrates Eddington's sense of humour, his intense interest in stellar interiors, to the theory of which he made so many contributions, and also a confidence in speculative thought which startled more ordinary physicists.

Prof. Douglas gives a clear account of Eddington's researches in astronomy, and shows the great impact which the theory of relativity made upon him. Motivated by his deeply sincere and religious character, he tried to present the theory as a continuous chain of deduction - a task which its author never attempted. The result was 'The Mathematical Theory of Relativity'; but although Einstein admired this exposition, his opinion was that this "creative achievement in the field of relativity and the theory of matter did not carry conviction." Eddington followed fearlessly the path that must inevitably lead, from initial postulates about observers and their measurements, to subjectivism. He did not hesitate to re-define the physical universe which, to Newton, had been the external cause of the sensations, as "the world which physical knowledge is formulated to describe," admitting frankly that it was an epistemological definition.

The well-known procedure of producing a formula with little, if any, physical basis, and claiming credit for some prediction made from it, while ignoring other predictions just as logically derived from it, which are absurd, or just wrong; and calling obscurities which can hardly be overlooked, "paradoxes," was behaviour unacceptable to a man of Eddington's integrity. He therefore had to claim equal status for his mathematical terms which had no counterpart in Nature ("lumber" - he called them) and was forced to say: "The things which we might have built, but did not, are there just as much as those we did build." It was but a short step further to his philosophy of selective subjectivism, with the claim that the fundamental laws and constants of physics are wholly subjective: This culminated in his amazing 'Fundamental Theory'.

We are too near to Eddington to assess his position in the history of human thought, but we owe a debt to Prof. Douglas for what she has given us. There are several illustrations of great interest, and an excellent photographic portrait which, even for those who never met him, will explain the author's quotation from Blake:

In what distant deeps or skies
Burnt the fire of thine eyes?

REVIEW.

THE SCIENTIFIC MONTHLY,

December 1957 (Marshal H. Wrubel, Indiana University)

The Life of Arthur Stanley Eddington. by A. Vibert Douglas. Nelson, New York, 1957. 207pp. Plates.

Eddington was a titan of astronomy whose contributions to the theories of stellar motions, relativity, stellar structure, and interstellar matter had a vital and lasting influence on the development of astrophysics in this century. His life spanned the years in which modern physics was being developed, and he was quick to see the important astrophysical consequences of the work of Einstein, Dirac, R.H. Fowler, and many others. What is more, he did not hesitate to communicate his ideas to the public, and, paralleling his scientific articles and books, there runs a series of popular expositions, written in a delightful style.

In contrast to his active scientific life, his personal life was uneventful. He was a quiet, introspective man with deep religious feelings; he had few intimate friends and found relaxation from his work by bicycling.

A. Vibert Douglas, a former student of Eddington's and now dean of women at Queen's University, Ontario, Canada, has succeeded in combining these widely differing facets of Eddington's life to present a picture of the man as a whole. She has chosen in many places to let Eddington speak for himself, and there are numerous nonmathematical excerpts from Eddington's books, illustrating his points of view and his command of language. Surely this will encourage many readers to go to the sources and experience the enjoyment of reading the original works.

One of the most interesting portions of the book is devoted to Eddington's scientific tussles with J.H. Jeans. The author gives, in very abbreviated form, the points at issue; the interested reader may also wish to read the relevant parts of E.A. Milne's biography of Jeans for a discussion more sympathetic to the other side.

At the time of his death in 1944, Eddington was at work on a book, published posthumously under the title 'Fundamental Theory'. This work has been severely criticized, and whether it will be his crowning achievement or most spectacular failure cannot yet be determined. A chapter is devoted to this work, pointing out the goals Eddington was seeking and not hesitating to quote his critics.

A concluding bibliography of his publications testifies to the scope of Eddington's interests and to his remarkable productivity.

Toronto Star,
January 26, 1957.

EDDINGTON CALLED GIANT AMID GIANTS

Astronomer and mystic, Eddington was "one of the super-giants in an age of giants, whose life as a thinker was filled with adventure, excitement, suspense, achievement. He lived through a period rich in new ideas to which his powerful mind contributed its own quota. Stellar movements, radiation pressure, the physics of the stars and nebulae and galaxies, relativity, quantum theory, the significance of the constants in nature - to harmonize all these, to formulate a fundamental theory was his vision."

So writes A. Vibert Douglas in Arthur Stanley Eddington (Thomas Nelson, Toronto, \$5), an illustrated 221-page biographical study. The author, who is now professor of astronomy at Queen's University, Kingston, is a former student and research associate of Eddington's and a past president of the Royal Astronomical Society of Canada. Following Eddington's death in 1944, aged 62, the astronomer's sister asked Sir Arthur's long-time friend, C.J.A. Trimble, to undertake a biography. All the documents she had given him and the material he himself collected were, however, finally turned over to Dr. Douglas for the present authoritative volume.

Sir Arthur is portrayed both as world famous man of science and as a reserved retiring private citizen, gaining a strength from the quietness of religious experience as a member of the Society of Friends. His biographer succeeds admirably in "the stereoscopic merging of the two into one faithful likeness of a great man."

Sir Arthur, he says in farewell tribute, took for his hunting-ground the universe from atoms to stellar galaxies and likewise the world unseen save by the eye of the soul - and therein imagination and reason went forth "in uncurbed glory."

To G. V. D. COPY

*Such a very nice letter
wonderful of him to write
me again after reading it*

Uxbridge, Ont.

Jan. 15/57

should be

My dear ^{a-}~~Dr. Douglas,~~

I wrote to you about two months ago, when your brilliant book came. Reading it sent me back to Eddington's Stars and Atoms, which greatly impressed me, more than a quarter of a century ago.

In 1936, at Trinity high table, I sat directly opposite Ramsay Macdonald, whose face I did not like. On Ramsay's left sat J.J. Thomson, who put away many glasses of claret during the lunch, and was very flushed in time. His face was interesting. Was J.J. head of Trinity? It was a day or so later that I ran into Stanley Baldwin, who was mercilessly chaffing Rutherford about the massive amounts of money he was consuming in research.

I've now slowly re-read your own book. It makes me aware, more than ever, of my capacious illiteracy in science. But of one thing I am sure. I have nowhere encountered such a comprehensive account of the revolution, during the first part of this century, in mathematics, physics and astronomy; and I gather that in Eddington's brain these three subjects met, as they met in few others.

You draw a delightful picture of him. In some respects he makes me think of Albert Schweitzer, whom I think the noblest man of our time. But the latter's faith, despite all his theological studies, is simple and childlike. You depict E. as a mystic, and the mystics are not childlike, I think, but endlessly subtle, and even baffling to the un-mystical. But surely, with all that bubbling humour, he was his own brand of mystic! The mystics I have met, Hindus in the flesh, and others in books, have all been pretty tense. Nor can I imagine Blake being interested in baseball fans!

He was a very great man, and layman though I am, I believe your book rises to his greatness.

Ever yours sincerely,

Carleton Stanley.

Letter from
Dr Carleton Stanley

1871

1871

at 10/10/71

1871

Faint, illegible text, likely the main body of the letter.

Faint, illegible text, likely the main body of the letter.

Faint, illegible text, likely the main body of the letter.

Faint, illegible text, likely the main body of the letter.

Faint, illegible text, likely the main body of the letter.

EXTRACT from
NEW STATESMAN, London
December 22, 1956

*Perhaps
already sent
This -
Born in
there after
a glance*

ARTHUR STANLEY EDDINGTON

A. Vibert Douglas
Nelson. 25s.

This is a competent exercise in hagiography upon a character and mind which could stand up to rougher treatment. Eddington was one of the oddest of fish, and needs writing about in three aspects - as one of the first theoretical astronomers of his day, as a personality of a bizarreness closely similar to C.L. Dodgson's, and as the proposer of a deductive epistemology which if right (which few now believe) made him a great man and if wrong a kind of Great Pyramid. Professor Vibert Douglas gives a good account of the first aspect, but is too gentle to deal adequately with the others. In a few years' time someone ought to have another shot.

C.P.S.

EDDINGTON: THE MAN WHO
'GOT INSIDE THE STARS'

ARTHUR STANLEY EDDINGTON by A. Vibert Douglas, Thomas Nelson and Sons
(Canada) Limited. Toronto. \$5.

Many readers will find this an uneven book, but its unevenness is due to an embarrassment of riches, to the dual problem of presenting a personality and his work. Eddington was a complex and charming if somewhat retiring person. The fields - astrophysics, atomic theory, relativity and cosmology - in which he distinguished himself, are abstruse. The biographer's task was no light one, to convey a lively sense of the substance of the man's achievement as well as an engaging account of the man himself.

Dr. A. Vibert Douglas, M.B.E., herself an astronomer of distinction, has performed her complex task in a most satisfying manner. As a graduate student she worked with Eddington at Cambridge University. She was a lecturer in physics and astrophysics at her alma mater, McGill, from 1923 to 1939, became Dean of Women at Queen's University, Kingston, Ont. in 1939 and acting professor of astronomy there in 1946.

One of the most revealing touches in this biography - a highlight on both subject and author - is the statement that on his first expedition, a trip to Malta to correct the recorded position of a navigational landmark, he took as companions two books: Don Quixote and Tristram Shandy.

Eddington came of Quaker stock. His father, a headmaster, died before the boy was two years old. The child early showed exceptional grasp of numbers and was especially fascinated by large numbers. At the age of eight or thereabout he set out to count all the letters in the Bible and had actually carried the enterprise through the Book of Genesis before he was persuaded to abandon it.

The extent of his mathematical gift was shown at Trinity College, Cambridge, when he became the first second-year man in the history of the university to win the distinction of Senior Wrangler. But he was by no means a mere theory-wizard - he was a firm believer in observation and experiment. At the Cavendish laboratory while still a student he tried to find the velocity with which negative corpuscles start from incandescent metals, and was "disheartened" by "arriving at no result."

From 1906 to 1913 he was Senior Assistant at the Royal Observatory, Greenwich, a position which involved a rigorous training in observational astronomy, an early discipline which later proved a source of strength. His

study of star drifts there resulted in the publication in 1914 of his first book: "Stellar Movements and the Structure of the Universe." This book which placed him among the acknowledged leaders in astronomical research, was a model of clarity and simple exposition.

But it was as "the English discoverer of Einstein" that he came into public notice. It was largely through Eddington's lucid writing that the English-speaking world first heard of relativity. And it was as an astrophysicist - "the man who got inside the stars" - that he earned the nickname of "the modern Archimedes". His mastery of all that was known in his day of atomic physics, plus his mathematical ability, plus truly remarkable intuitive powers, enabled him to clear up many puzzling things about nature.

One of the most interesting chapters is that which Dr. Douglas devotes to Eddington's spiritual life, his pursuit of what the Quakers call the Inner Light.

When he died in November 1944 Eddington left an unfinished work, "Fundamental Theory", whose immense value, according to one authority, "lies in the suggestiveness of its ideas . . . the greatest contribution to physics since 1915."

Asked on one occasion if he had yet succeeded in solving a certain stubborn problem, Eddington replied, "No, but I have learned to live with it."

- R.P.

Review from "Sky and Telescope" November, 1957, of "Arthur Stanley Eddington"

by A. Vibert Douglas.

Writing the biography of a manysided genius would have been difficult even under the best circumstances. In Sir Arthur Eddington's case the task is made more difficult because of his shy and retiring nature. As one whose interest in astronomy was kindled by the writings of Eddington, the reviewer had been looking forward to reading this work by Professor Douglas, who was a student and associate of the famous astrophysicist. She has done a commendable job, and fellow scientists will be indebted to her for providing an integrated view of the activities of a truly great scientist.

In the first two chapters are traced as far as is possible the early influences in Eddington's life that shaped his later interests. There is a vivid account of Eddington as a happy young man with prodigious intellectual curiosity and the ability to follow up this curiosity in any field he liked. That circumstances were favorable for his activities is both a commentary on his attitude to life and on the state of the world at that time.

After spending seven fruitful years as chief assistant at Greenwich, Eddington returned to Cambridge in 1913 as Plumian Professor. He was to remain in the same position until his death in 1944. It is sometimes forgotten that Eddington, who is best remembered for his theoretical work, during his years at Greenwich had "to observe at nights a good deal in order to understand the instruments thoroughly."

The author gives a fairly general but interesting account of Eddington's work, beginning with his early studies of star motions, through stellar structure, relativity, and cosmology. In every one of these fields he had the uncanny knack of selecting the most significant problems and creating whole new branches of astrophysics. There is also a lively narrative of his controversies with his fellow astronomers, especially Sir James Jeans. In these controversies we see the growing pains of astrophysics as a subject with its own rules of the game.

Apart from his astronomical researches, Sir Arthur was very active both in the popularization of science and the development of a philosophy of science. In later life, one of the criticisms by his less broadminded colleagues was that he mixed mysticism and science instead of using his brilliant analytical talents for scientific study only. As the book indicates, "one of the most powerful factors in the formation of Eddington's intellectual outlook and spiritual perceptivity was the Quaker atmosphere of his home."

In a chapter titled "Concerning the Unseen World," Miss Douglas gives a lucid outline of Eddington's personal philosophy. In these days of unquestioned obedience to specialization this outlook is like a breath of fresh air. One gets a glimpse of the essential morality and the humility of the man who could remark at the end of a classic on stellar structure, "Somewhere in the present tangle of evolution and sources of energy I have been misled: and my guidance of the reader must terminate with the admission that I have lost my way." Eddington did not isolate his scientific work from his philosophy of life, and he felt a deep moral responsibility for all his actions.

There may have been more brilliant scientists, but one doubts whether there have been many endowed with his wisdom.

The penultimate chapter is devoted to the most controversial of all Professor Eddington's works. Most of his last years were occupied in building up an elaborate theory of the microscopic and macroscopic structure of the universe. The final portions of this study, entitled Fundamental Theory, were published posthumously. The whole work is so abstruse that even a well-known cosmologist remarked "The analysis ... is so very complex and based on such extremely difficult arguments that most scientists found themselves unable to examine the theory in detail." No review of Miss Douglas' book can be complete without commenting on the literary excellence of the biography of a man who was noted for his facility with the pen and the imagery of his descriptions of extremely difficult concepts. Studded with generous quotations from Eddington's writings, this biography will provide fascinating reading for both the professional and amateur astronomer.

T. K. Menon.
Harvard College Observatory.

COPY

Gonville and Caius College,
Cambridge.

3.1.57

Dear Dr. Douglas,

May I first thank you for your kind card of Greetings and Good Wishes then send you my best wishes for a very Happy ^{New} Year. And lastly let me send you my congratulations both on the successful appearance of the Eddington volume and on the book itself.

I can now tell you how much I enjoyed reading it and also how generally it is appreciated by people in Cambridge. May I say that the parts I enjoyed best were your reactions to A.S.E. as a student attending his lectures and your account of the old **Jeans** - Eddington - Milne battles at the R.A.S. I should add that you have made an uneventful life full of interest.

With kindest regards

Yours sincerely,

(Signed) F.J.M. Stratton

than 10 years are also unrealistic in view of the time it takes to turn a scientific discovery into a prototype of a new invention.

Note that the definition says nothing about who makes the judgment. Indeed, the judgment will depend on the judge, in accordance with the uncertainties and the speculative nature of science policy decisions. Yet, this conception of the dichotomy provides a useful tool both for scientists and for science managers.

Reference

1. M. J. Moravcsik, *How to Grow Science*, Universe Books, New York (1980).

MICHAEL J. MORAVCSIK
University of Oregon
Eugene, Oregon

4/81

More on Eddington

A Daniel come to judgment!

Paul Nawrocki is right on in his letter about Arthur Stanley Eddington in your March issue (page 81).

I presume that by regarding it as of less interest than the size of posters and relegating it to the very end of the Letters column, you were moved by the knee-jerk reaction which has characterized most of the physics establishment since 1932 in its attitude to Eddington—an attitude governed by implicit and unexamined presuppositions. For decades, physicists have tried to convince themselves that they have no metaphysical prejudices. In fact, of course, all of us do and they determine our approach to physics.

For any student of the history, philosophy or sociology of science, the story of the reaction of the physics community to the work of Eddington during the last two decades of his life is a rich mine which no one to my knowledge has begun to exploit.

As Nawrocki points out correctly, many ideas now touted as daring discoveries of contemporary physicists were announced 10 or 20 years before anyone else by Eddington. For example, a basic concept to which Nawrocki does not refer is that of "quasi-particle," which is often attributed to Landau. The idea is nothing other than the "top particle" of *Fundamental Theory* (FT) and that is simply a new name for the "added particle" of *Relativity Theory of Proton and Electron* (RTPE) of 1936. Eddington's discussion of the concept of particle on pages 31-32 of FT should be read carefully by every aspiring physicist.

I had the privilege of writing my thesis on RTPE during the years 1940-43 under the supervision of Leopold Infeld. Though his preoccupation with

war research on electromagnetic theory left him little time, he kindly allowed me to lecture to him weekly on what, if anything, I understood of the thought of Eddington. He frequently expressed bafflement but encouraged me to go on.

For the record, here are a few Eddington stories.

One day, after returning from a conference in Washington, Infeld told me that at the meeting Gamow had whispered to him "Leopold, come into my office." They entered, Gamow closed and locked the door behind them and, in a conspiratorial voice, continued, "Look, I have received two free copies of Eddington's book to review. I will give you one. We can read them secretly and discuss them, but we must let no one know that we take it seriously. We would be considered insane."

A friend of mine studied under Oppenheimer in California and sought advice as to a good book to study relativity. The great man responded enthusiastically. "Why Eddington, of course, there is nothing better!" My friend returned after consulting the library catalogue. "Did you mean RTPE or the *Mathematical Theory of Relativity*?" Oppenheimer almost had apoplexy and spat out in scathing tones, "The latter of course. The other is garbage, absolute bilge." My friend slunk away, wondering how the man who wrote the perfect book on relativity (and also, incidentally, almost single-handedly created the science of astrophysics) had managed to write a whole volume of "bilge."

Ten or twelve years later, my friend was at the above-mentioned conference with Infeld and Gamow and listened to a talk by Oppenheimer on the remarkable properties of the fine-structure constant. Since Oppenheimer said essentially nothing that had not been in Eddington's papers of 1930-35, my friend asked Oppenheimer if he now had more sympathy for Eddington's ideas. Nuclear explosion! "No, of course not. They are absolute nonsense. Go and speak to X. He studied under Eddington and will tell you there is nothing in his theories."

In fact, X modestly disclaimed having fully penetrated the thought of Eddington but felt sure it was quite important.

There is much evidence that Eddington possessed a highly developed physical intuition which led him to zero in on the key points for understanding an extraordinary range of physical phenomena. A well-known astronomer told me that, not infrequently, he had witnessed a lecture by Eddington after which some bright young man had been able to demonstrate that there was an egregious logical or mathematical error in Eddington's argument. In each

however, when the observational data were fully in, Eddington's conclusion proved to be essentially correct! Personally, I obtained a PhD by showing that RTPE contained a major and several minor errors. However, the more errors I found the greater conviction I developed that Eddington was basically correct and that he was one of the truly great geniuses of 20th century physics.

As A. V. Douglas has revealed in her sensitive and penetrating biography of Eddington, intellectually he was a loner and temperamentally opposite to the self-assured dogmatic masters who have created "schools" of physics which dominated the development of our science.

In recent years, applied physics (to use what Lewis Branscomb considers a no-no term) has achieved extraordinary successes. However, fundamental physics has been essentially ptolemaic. The voices which seem to me to have addressed basic issues in a serious manner were those of Alfred North Whitehead and Eddington. When an informed history of our era is finally written, Eddington may well emerge as the most prolific and creative genius in the physics of the 20th century.

A. J. COLEMAN
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5/81

Delbruck scattering

Gunther Stent in his informative obituary of Max Delbrück (June, page 71) wrote about Delbrück scattering: "... in the 1950s Hans Bethe eventually demonstrated the existence of the phenomenon..." In the name of historical and scientific accuracy I must take issue with this statement.

I am sure that Stent will agree with me that the existence of a natural phenomenon cannot be demonstrated by a theorist, no matter how outstanding that theorist might be. It can only be predicted, and that was first done correctly by Max Delbrück on the basis of quantum electrodynamics.

Now I happen to have worked on the theory of Delbrück scattering in the early 1950s with Hans Bethe and others at Cornell. We did not demonstrate its existence but we computed scattering amplitudes. In the elastic scattering of gamma rays by heavy atoms Delbrück scattering occurs coherently with nuclear Thomson and atomic Rayleigh scattering. Rather accurate computations are therefore needed for the analysis of such an experiment.

Our work stimulated R. R. Wilson who was also at Cornell at that time, to measure the effect.¹ His was the first in a long line of experiments which continue to this day. One might thus

C-7

THE FRIEND,
December 7, 1956

ARTHUR STANLEY EDDINGTON:
A BIOGRAPHY

Friends will join with all students in the world of science in expressing thanks to Dr. A. Vibert Douglas, Professor of Astronomy at Queen's University, Kingston, Ontario, for his biography of Arthur Stanley Eddington, which has just been published.

Dr. Douglas was a former student of Arthur Eddington, and he writes very fully of Eddington's student life, of his work at the Royal Observatory, and later as Plumian Professor of Astronomy at Cambridge. He follows this with an account of his great contribution to scientific knowledge, and an analysis of his "Fundamental Theory"-his search for an understanding of the significance of the constants of nature, and his recognition of atomicity as the most fundamental problem. Could a fundamental theory be formulated embracing all the basic phenomena of physics and cosmology? These profound and difficult questions are discussed in this biography with such clarity that the lay reader, while being unable to follow the profundity of Eddington's thought, will nevertheless be given some glimmer of understanding, more than he had before, of the nature of the problems involved. And that is something very valuable indeed in the world in which we live today.

Readers of The Friend, however, will be deeply grateful to the author because of his skill in portraying, not only Eddington the scientist, but also Eddington the Quaker - the humble, friendly man who walked humbly with his God. It will be news to many that, on his mother's side, he was descended from John Cama and Anne Audland, Westmorland folk who were among the "valiant sixty" of the early formative days of Quakerism. Arthur Eddington himself was born in Kendal, where his father was Headmaster of Stramongate School. When he was a child he knew his 24-times table before he could read, and his progress from Stramongate to Dalton Hall, and to Cambridge, was triumphant at every stage.

Throughout his life he maintained his loyalty to the Society of Friends. He was an active member of the Friends Guild of Teachers, and took part in the Summer School Movement of the first decade of this century, helping the Society of Friends to understand and accept the new results of scholarly research. Cambridge Friends remember him as

a faithful and regular attender at Sunday morning Meeting, as a member of the Meeting's Finance Committee and auditor of its accounts. He seldom spoke in Meeting, but would occasionally speak after Meeting to the Young Friends' group on some aspect of the relation between religion and science.

His greatest contribution as a Friend was perhaps his Swarthmore Lecture Science and the Unseen World (1929), in which, as a scientist, he examined the validity of the mystical approach to reality. He asserted that scientific researches are not the only road to truth, but that mystical insight is an equally valid path. He himself was a mystic, and saw no contradiction between the two aspects of life. redouble our thanks to Dr. Douglas for the very helpful and understanding picture he has. He knew the Scriptures well, and his favourite passage is found in I Kings xix, 11 to 13:

And, behold the Lord passed by, and a great and strong wind rent the mountains, and brake in pieces the rocks before the Lord; but the Lord was not in the wind; and after the wind an earthquake; but the Lord was not in the earthquake; and after the earthquake a fire; but the Lord was not in the fire; and after the fire a still small voice . . . And, behold, there came a voice unto him, and said, What doest thou here, Elijah?

Eddington's comment on this passage (in his Swarthmore Lecture) was: "Wind, earthquake, fire - meteorology, seismology, physics - pass in review; the Lord was not in them. Afterwards a stirring, an awakening in the organ of the brain, a voice which asks 'What doest thou here?'"

Dr. Douglas writes of Eddington's personal life and of his Friendly interests with a thoroughness and a sympathy which puts us much in his debt. It is particularly interesting to have reproduced his statement to the C.O. Tribunal, before which he appeared during the First World War. It is worth repeating here:

My objection to war is based on religious grounds. I cannot believe that God is calling me to go out and slaughter men, many of whom are animated by the same motives of patriotism and supposed religious duty that have sent my countrymen into the field. To assert that it is our religious duty to cast off the moral progress of centuries and take part in the

passions and barbarity of war is to contradict my whole conception of what the Christian religion means. Even if the abstention of conscientious objectors were to make the difference between victory and defeat we cannot truly benefit the nation by wilful disobedience to the Divine will.

The very simplicity of this statement is characteristic of the man, who combined the most profound capacity for original thought with a simplicity of character and a deep humility. Those of us who knew Arthur Stanley Eddington give thanks for our remembrance of him, and redouble our thanks to Dr. Douglas for the very faithful and understanding picture he has given us in this book.

Howard Diamond.

*Jesus College, Cambridge
Hon. Sec. Arthur Stanley Eddington
Memorial Trust.*

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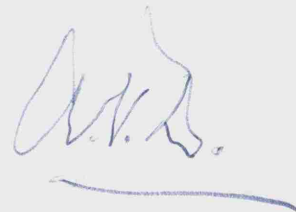
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