CHAPTER I

MERCHANT TAYLORS' AND CAMBRIDGE

BORN on 11 September 1877 at Ormskirk, Lancashire, James Hopwood Jeans came of a family of journalists. Both his grandfather and his great-grandfather had owned newspapers and his father's cousin, Sir Alexander Jeans, had been proprietor of the Liverpool *Daily Post* and *Echo*. His father, William Tulloch Jeans, was a parliamentary journalist, representing the *Globe* in the press gallery of the House of Commons. He had a remarkable knowledge of parliamentary procedure and his Fleet Street colleagues always turned to him in their troubles. He was also a keen student of economics and his published works included *The Lives of Electricians* and *Creators of the Age of Steel*.

James's mother, from whom he derived the name Hopwood, came from Stockport and belonged to an evangelical family. Her great-great-great-grandfather had been an Independent minister in Cromwell's time and his small chapel, now used as a school, still stands at Marple, Cheshire. For a time, during James's infancy, his parents lived at Brighton. When he was three years old, they moved to London, living first at Tulse Hill and afterwards at Clapham Park.

James was a precocious child. He could tell the time at the age of three and could read when he was four. He seized upon anything that came his way, even a *Times* leading article which he would read aloud to his parents. The home atmosphere was strictly Victorian, especially in relation to religious observance, and James, naturally shy, began to develop his own interests. He took long walks in London and bicycled into the surrounding country. Later, he accompanied his father very happily on walking tours and the father never ceased to encourage the boy's intellectual development.

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From the beginning James displayed a passion for numbers. He could memorize them with ease and at the age of seven made a practice of factorizing cab-numbers. About the same time he came upon his father's book of logarithm tables. He could not make out their purpose, but seized the opportunity of learning the first twenty logarithms by heart. Again, when his mother once lost her ticket on a railway journey, he was able to satisfy the inspector by quoting its number.

Another subject which fascinated him was that of perpetual motion, on which he used to ponder during long services at church. But his greatest enthusiasm was reserved for clocks. All his early drawings contain clocks of all shapes and sizes and sometimes shops full of rows of clocks.

His first written work was a tiny manuscript of nine pages, bound in light blue covers and entitled 'Clocks. By J. Jeans'. The work was fully illustrated inside and out. The text describes the escapement principle in spirited style and gives detailed instructions for constructing a clock out of pieces of tin and other material.

In September 1890 James entered the Merchant Taylors' School as a day-boy. The school, which then occupied the buildings vacated by Charterhouse, was about two miles away and James frequently walked that distance four times a day. Sometimes, however, he went by train and often in company with W. P. (now Sir William) Elderton, with whom he formed a close friendship. Neither of them had a talent for games and Jeans's shyness and his slightly abrupt manner of speaking—characteristics which remained throughout his life—debarred him from making a wide circle of friends at school, but Elderton quickly broke through the shyness and, in particular, derived real enjoyment from Jeans's easy explanations of mathematical difficulties.

Others of Jeans's contemporaries at school were R. V. Laurence, D. A. Winstanley, Evans (of the *Broke*), Cyril Norwood, Herbert Creedy, Major Greenwood, C. H. Reilly,

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M. N. Tod, F. J. W. Whipple and F. W. M. Draper. The
Headmaster was W. Baker, who founded the Modern Side
but preserved the seniority of the Classics. The Classical Side
had eight monitors and eight prompters, the Modern only
four of each. Jeans reached the lower sixth on the Classical
Side in 1893 and then moved over to the Modern Side. At
Easter 1894 he was at the top of the upper sixth Modern and
two years later he was 2nd Modern monitor and first in
mathematics. In November 1895 he won an entrance
(major) scholarship at Trinity College, Cambridge.

At Merchant Taylors' Jeans came under three mathe-
matical teachers: the Rev. S. T. H. Saunders, S. O. Roberts,
and C. W. Payne. Of these the first became vicar of a city
church and at the age of ninety-one could still remember
Jeans's quiet industry—'a schoolboy', he said, 'who never
got up to mischief'. Roberts, who had been Eighth Wrangler
in 1880, was too quick for many of the boys but provided
Jeans with a real stimulus towards mathematical study;
Payne was a sympathetic and more generally popular teacher.
The three of them, as Sir William Elderton remembers, made
a good team.

F. W. Morton Palmer (afterwards Scholar of Jesus College,
Cambridge, and for many years in medical practice at
Worthing) who, under Saunders, sat at the same desk with
Jeans recalls that his favourite attitude was to sit with his
elbow resting on his crossed knees and his chin cupped in
his hand. It was a habit that persisted throughout his life.

W. E. Bowers (later Secretary of the Imperial Continental
Gas Company) was, in Jeans's view, one of the ablest of
his contemporaries at school. He helped Jeans with his
German and Jeans helped him with his mathematics.
Many boys, indeed, were impressed by the quickness of
Jeans's exposition of a mathematical difficulty. In later
years they were astonished at his vogue as a popular writer.
At school, they said, he could never see that anything needed
explaining. Bowers also remembers Jeans taking a small

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female part in scenes from *The Critic* at the Speech Day of 1894. What is more important is that he recalls him playing the school organ in the dinner hour. Jeans had, in fact, begun to play the organ at the age of twelve; it was an instrument that was to figure largely in his life.

Jeans went up to Trinity in October 1896 with a Parkin scholarship from his school as well as his entrance (major) scholarship. He read mathematics. His tutor was A. W. Verrall and his director of studies G. T. (later Sir Gilbert) Walker,* who had been Senior Wrangler in 1889.

Other members of the college mathematics staff during Jeans's undergraduate days were J. W. L. Glaisher, W. W. Rouse Ball, A. N. Whitehead, R. A. Herman and E. T. Whittaker.

Men at Trinity reading mathematics who had Rouse Ball for tutor also went to him as director of studies; other mathematical undergraduates went to Whitehead or Walker in alternate years. Those were the days of the unreformed Mathematical Tripos; and Whitehead and Walker thought it unfortunate for a mathematician to spend three years over what was essentially elementary work (Part I of the tripos), and only one year on the living and growing portion of the subject (Part II). They agreed that if they had an exceptionally able pupil they would advise him to risk taking Part I of the tripos in two years, thus leaving two years to work for Part II. In the entrance scholarship examination both Jeans and his Cambridge contemporary, G. H. Hardy, had been outstanding.† Early in the Michael-mas term of 1896 Walker sent for Jeans and Hardy and advised them to take Part I of the Mathematical Tripos

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* Director-General of Indian Observatories, 1904–24, and Professor of Meteorology for many years at the Imperial College of Science. Among other studies, Walker is distinguished for his work on the theory of the boomerang.

† Hardy's English essay on 'Historical Novels' might, in the opinion of the classical examiners, have been accepted by the *Nineteenth Century* or the *Fortnightly* for publication; and Jeans's essay was above the average.

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in two years. He told them that he could not guarantee
that they would come out higher than fifteenth in the list
of Wranglers, but he undertook that they would never
regret it. They accepted his advice, and went to R. R. Webb,
the most famous private coach of the period.

Walker showed courage in giving the advice, since both
Jeans and Hardy were potential Senior Wranglers; they,
too, showed courage in accepting it. Part I of the tripos had
not before been attempted in two years and the risk of
a lower place was obvious. The sequel was to justify both
Walker and his pupils.

In March 1897 Jeans was elected to an ordinary major
scholarship at Trinity and so gained his place on the founda-
tion. At the end of his first year, he told Walker that he had
quarrelled with Webb, his coach. Walker accordingly took
Jeans himself, and the result was a triumph. In the Part I
Mathematical Tripos list of 1898, Jeans was bracketed
Second Wrangler with J. F. Cameron (later Master of
Gonville and Caius College); R. W. H. T. Hudson was
Senior Wrangler and G. H. Hardy Fourth Wrangler. After
the results came out, Jeans told Elderton that Hudson was
fairly easily head of the field, and that he deserved to be
since he could do seven or eight hours of real work a day,
and did it, whereas six hours of real work was ample for the
rest of them.

Three years of residence were required for a degree, and
Part I of the tripos alone, taken in two years, did not carry
with it the right to supplicate for a B.A. degree. Con-
sequently, in order to take their degrees in 1899, Jeans and
Hardy were obliged to pass the 'special' examination in
mathematics and technically they proceeded to ordinary,
not to honours, degrees. It may well be that the movement
for the abolition of the order of merit in Part I of the tripos
was accelerated when it was realized that the best men
would from now on take Part I in two years. Be this as it
may, the order of merit was abolished in 1909, partly as

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a result of a pamphleteering campaign in which Hardy took a prominent part.

During his undergraduate career, Jeans had a grand piano in his rooms and took lessons in playing from Kathleen Bruckshaw, the distinguished pianist. He frequently acted as accompanist at undergraduate sing-songs and became secretary of the Query Club.*

His work for Part II of the Mathematical Tripos was interrupted by a tubercular infection of the knee, caused by a minor domestic accident. He left Trinity after the Easter term of 1899, and went first to a sanatorium at Ringwood, Hants, and later to Mundesley, Norfolk, where after two or three years he was completely cured. He returned to Cambridge to take Part II of the Mathematical Tripos in 1900 and was placed in the second division of the first class, Hardy being in the first division. Jeans's lower place was no doubt attributable to his enforced absence from Cambridge. Shortly afterwards he was elected to an Isaac Newton studentship for astronomy and optics, and in 1901 was awarded a Smith's Prize for an essay entitled 'The distribution of molecular energy'. Hardy won a Smith's Prize at the same time, and the two were declared to be Smith's prizemen 'with unspecified relative merit'. The subject of Jeans's essay is of considerable interest as showing that at this early stage he was preoccupied with the great problem of the equipartition of energy in a dynamical system specified by a large number of co-ordinates. A paper with the same title, presumably a version of the Smith's Prize Essay itself, was published in the *Philosophical Transactions* of the Royal Society in 1901.

Jeans was elected a Fellow of Trinity College, Cambridge, in October 1901, and his old schoolfellow, Reginald Vere Laurence, the historian, was elected to a fellowship at the

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* One of the Rothschilds, who was a member of the club, was successfully coached for Little-Go by Jeans and marked his gratitude by the gift of a tie-pin, set with diamonds in the form of a query mark. Jeans's sister still possesses it.

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same time. In a letter to another schoolfellow, F. W. Morton Palmer, Jeans wrote: ' I am very glad that Laurence has been elected on the same day as myself after the long time we have been together.' Hardy had been elected to a prize fellowship in the previous year, and used to say that he considered his election to a Trinity prize fellowship as the most important event in his career. For Jeans it was similarly of supreme importance since it enabled him without financial worry to pursue the cure of his knee at the sanatoria. The disease slightly affected both wrists and knees before it was finally overcome, in 1902 or 1903.

Jeans took his M.A. by proxy in 1903, and in the following year was appointed University Lecturer in Mathematics. This post he held until he left for Princeton in 1905.

During his enforced leisure at the sanatoria, he wrote his first treatise, the *Dynamical Theory of Gases* (published 1904, second edition 1916), which in its successive editions has been used by generations of students and research workers. The contents of the volume will be described in more detail later.

During his sojourn at Mundesley, Jeans kept in frequent touch with many of the Fellows of Trinity. The following letter (undated) from G. H. Hardy not only shows the pleasant relationship which existed between them, but reveals a certain interest on Hardy's part in ' applied ' mathematics, an interest which Hardy consistently disclaimed. The paper of E. T. Whittaker's to which he alludes is presumably that on a general solution of Laplace's equation (*Mathematische Annalen* (1902), 57, 333).

Trinity College, Cambridge

My dear Jeans,

I was very glad to hear such an encouraging report; I suppose we may really expect you up next term anyhow. Probably you have heard all the news from here, about Sedgwick, etc. It was a dreadful question to vote on: I went against ultimately. The

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case for was so transparent though that it was very hard to be
reasonable.

I was really writing to ask for a copy of your latest paper,
which seems to be rivalling Whittaker's in notoriety.

> Yours affectionately,
>
> G. H. HARDY

Or, again, this from H. F. Stewart:

> 30 *Thompson's Lane, Cambridge*
> 18 Feb. 1903

My dear Jeans,

I am so very glad to hear such a satisfactory account of your-
self from yourself, and sincerely trust that you will continue to
do well and soon be back here. *Soyez tranquille* on the score of
the bedmaker on Staircase I, Nevile's Court. She is a treasure
and will look after you with every possible attention.

With regard to a harpsichord, I know of no place where they
are stocked! But Mr Arnold Dolmetsch whose address it will be
easy to discover could doubtless put your friend into the way of
acquiring one. Those that I have knowledge of have all been
picked up in farm-houses here and there and have been entrusted
to Dolmetsch's care for repairs and tuning.

As for Trinity news I don't know that there is much.—Does
the arrival of my infant daughter interest you? She is a fortnight
old and has already been vaccinated. She has good long fingers
for the piano and even now seems to be wanting to play some-
thing. I am looking forward to introducing you to my wife and
her when you come up again.

It will be nice to have you underneath me in college. I spend
a good deal of time in my rooms and shall descend on you when
I want to make music on the spot, as my piano is here.

Forsyth is probably going into G. T. Walker's rooms which
leaves a good set but a cold set vacant just opposite. I wonder
who will be your *vis-à-vis*. Laurence has transferred himself to
Whewell's Court where he is installed with some dignity chez
Langley. We are all agog about the new professor [Lucasian].
I wonder who it will be. Personally and apart from mathe-
matics I should like to see Horace Lamb in the post—Himself

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and his family would be a notable acquisition to Cambridge sorority, and I believe he is worthy of the professorship, is he not?

Now I must stop. When I find Dolmetsch's address I'll write again.

Yours very sincerely,
H. F. STEWART

Finally there is one from R. St J. Parry:

Trinity College, Cambridge
4 May 1902

My dear Jeans,

I had quite hoped to get a mid-week letter off to you this time; but the fates forbade; and here is Sunday again—with an excellent sermon from H. F. Stewart. It was splendid of you to write me such a screed. I wanted to get a kind of idea of what was going on and your letter gave it. I hope too you liked Miss Todd and Miss Jackson—tho' I don't know which of the latter came.

My youngest brother has arrived this week from Persia after five years' absence—very delightful. He has grown a beard; and the bottled-up conversation of five years is being gradually unladen! Also we hear today that my S. African farmer brother is coming home for an operation on his arm. It will be very remarkable that all my brothers will be in England together this summer—7 of us alive. We are having it quite cold; but healthy. Rix has been up this week for the final part of his 3rd M.B.—as delightful as ever but I am afraid overworking. He is very much afraid that he has been ploughed: the result comes out tomorrow.

Gaye and Hardy are taking Jackson and me to the Theatre on Wednesday—to see the *Yeomen of the Guard* or some such! We are greatly excited.

I hope you have enjoyed reading the proposed Statutes. We are sanguine enough to hope that we may get thro' them in one afternoon. I don't know why people should want to talk much more.

I hear from Walker that you are going to take the rooms above his. I believe they are really the best for you among those that are vacant; though I wish you could have come to M.N.C.

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Would you care for a copy of the *Essays of Elia* to read again? I have got two copies: they are just the thing for occasional dippings.

I shall not send this if I don't stop now.

Yours ever affectionately,

R. Sᴛ J. P.

It was in 1905 that Jeans published his definitive solution of the problem of the partition of energy between matter and radiation according to the classical mechanics, and so, by showing that his solution was in rank contradiction with experience, made the acceptance of Planck's quantum theory ultimately certain. The problem had been attacked by Lord Rayleigh, who had indeed found the form of the formula for the theoretical spectrum of black-body radiation (or complete radiation, as it is better called), but Rayleigh gave a wrong numerical factor. Jeans's re-derivation of the formula and his correction to Rayleigh's formula were at once admitted by Rayleigh; and the formula, $8\pi RT \lambda^{-4}\, d\lambda$ for the energy lying between wave-lengths λ and $\lambda + d\lambda$ in complete radiation of temperature T, is known as the Rayleigh-Jeans formula. It will be explained more fully in Chapter ɪx.

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