James Jeans

Science is created by those who wish to understand nature and the universe in which they live. Questions of the sort “What makes the universe tick?”, “Does nature obey discoverable laws?” and “What is the origin of the universe?” fascinate them. In trying to answer such questions they shed the cloaks of scientists and put on the mantle of philosophers. One who gave such questions considerable thought was British mathematician, astrophysicist, and science popularizer **James Hopwood Jeans (**September 11, 1877 – September 16, 1946). His career began as a mathematician, but his major scientific contributions were in molecular physics and astrophysics. He proposed a theory that the planets of the Solar System were formed from natural material pulled from the Sun by the gravity of a passing star. He claimed that matter is continuously created throughout the Universe, a forerunner of steady-state theory.

Jeans was born into a very religious family at Ormskirk, Lancashire. His father, of Scottish descent, was a parliamentary journalist who wrote two books on the lives of scientists. Hopwood was the maiden name of his mother who came from the north of England. Jeans was a precocious child, given to melancholy. He amused himself by memorizing seven-place logarithms and taking clocks apart to study their mechanisms, writing a booklet about clocks at age nine. He attended Merchant Taylor’s School from 1890 to 1896, and then entered Trinity College, Cambridge, where he showed exceptional ability in mathematics. He was Second Wrangler in the Mathematical Tripos examinations of 1898, two places ahead of his classmate G.H. Hardy. Jeans was awarded a Smith’s prize and an Isaac Newton

Studentship in astronomy and optics. In 1901 Jeans was elected a Fellow of Trinity College, obtaining his M.A. in 1903. His career as University Lecturer in Mathematics was interrupted when he contracted tuberculosis and was forced to rest at a sanatorium. He used the time to work on his first treatise, *The Dynamical Theory of Gases* (1904), which became a standard textbook.

From 1905 to 1909 Jeans was a professor of applied mathematics at Princeton University, where he completed two additional textbooks *Theoretical Mechanics* (1906) and *The Mathematical Theory of Electricity and Magnetism* (1908). It was also during this time that he married wealthy poet Charlotte Tiffany Mitchell of the celebrated New York Tiffany family, with whom he had a daughter. In 1909 Jeans returned to Cambridge where he was appointed Stokes Lecturer in Applied Mathematics. Three years later he retired, at age 35, to Guildford to devote himself completely to mathematical research and writing books. His *Report on Radiation and the Quantum Theory* (1914) helped spread acceptance of quantum theory. He then transferred his attention from molecular physics to astronomy. Three years later, he was awarded the Adams Prize for his *Problems of Cosmogony and Stellar Dynamics* in which he rejected Laplace's nebular hypothesis for the creation of the solar system. He proposed a tidal theory based on a star passing close to the Sun and pulling matter from it that condensed into the planets. He believed that life could only exist on just the right kinds of planets created by the passing of stars. Because "stars are so sparsely scattered in space that it is an inconceivably rare event for one to pass near to a neighbor," Jeans considered life to be extremely rare in the universe. He wrote:

> "The type of conjecture which presents itself, somewhat insistently, is that the centers of the nebulae are of the nature of "singular points," at which matter is poured into our universe from some other, and entirely extraneous, spatial dimension, so that, to a denizen of our universe, they appear as points at which matter is continually created."

Jeans was a research associate at Mt. Wilson Observatory in Pasadena, California from 1923 to 1944. In 1928 he was knighted, and then shocked his friends by turning his attention from research to writing popular accounts of astronomy and cosmology. His highly successful books made him the best-known scientist in the United Kingdom. His books included *The Universe Around Us* (1929), *The Mysterious Universe* (1930), *The New Background of Science* (1933), *Science and Music* (1938), and *Physics and Philosophy* (1942). So widely read was *The Mysterious Universe* that it was translated into13 different languages**.** To illustrate Jeans' imaginative means of making science meaningful to general audiences, consider his approach to showing the relative size of things, which range "from electrons of a fraction of a millionth of a millionth of an inch in diameter, to nebulae whose diameters are measured in hundreds of thousands of millions of miles." He wrote that a model of the universe in which the sun was represented by a "speck of dust 1/300 of an inch in diameter would have to extend 4 million miles in every direction to encompass even a few neighboring galaxies." Other mind-boggling thoughts on the size of things included: "Empty Waterloo Station of everything except six specks of dust, and it is still far more crowded with dust than space with stars"; "The number of molecules in a pint of water placed end to end … would form a chain capable of encircling the Earth over 200 million times"; "The energy in a thimble of water would drive a large vessel back and forth across the ocean twenty times"; A pinhead heated to the temperature of the center of the Sun "would emit enough heat to kill anyone who ventured within a thousand miles of it.

Despite his work in astrophysics and cosmography, Jeans always considered himself a mathematician. He also nourished a lifelong passion for music. He began playing the organ when only twelve, and when he built his home he incorporated a pipe organ, which he often played for three or four hours a day. His first wife died in 1934 and the next year, Jeans married concert organist Suzanne Hock, with whom he had three children. He redesigned the acoustics of the house and had a second pipe organ installed so they both could play their instruments without disturbing each other. In his *Science &*

Music, he explained in simple terms the known mathematical and physical foundations of music. Among other things, he denied the claim of some pianists that the quality of sound can be affected by the way the key is depressed. His decision to put aside the strenuous work of a researcher may have been influenced by his poor health. As early as 1917, he showed signs of heart problems. He recovered from a heart attack in January 1945, but his second heart attack in September 1946 proved fatal. Reportedly Jeans spent part of his last day on earth listening to music.

Jeans said that the universe looked more like a great thought than a great machine, and that the Mind is not an "accidental intruder into the realm of matter." He considered God to be the First Cause, the ultimate *raison d'etre*. He believed that if scientists worked hard enough they would be able to read God's mind. When Jeans proclaimed, "From the intrinsic evidence of his creation, the Great Architect of the Universe now begins to appear as a pure mathematician," he was expressing his belief that mathematics was the proper means for interpreting nature. In *The Mysterious Universe*, he wrote:

> "We discover that the universe shows evidence of designing or controlling power that has something in common with our own individual minds – not, so far as we have discovered, emotion, morality, or aesthetic appreciation, but the tendency to think in the way which, for want of a better word, we describe as mathematical."

Quotation of the Day: "Phenomena come to us disguised in their frameworks of time and space; they are messages in cipher of which we shall not understand the ultimate significance until we have discovered how to decode them out of their space-time wrappings." – James Jeans