Love, Augustus Edward Hough | Encyclopedia.com

(b, Westonsuper-Mare, England, 17 April 1863; *d,* Oxford, England, 5 June 1940)

applied mathematics, geophysics.

Love was one of four children and the second son of John Henry Love, a surgeon of Somerset shire. He was educated at Wolverhampton Grammar School, and his subsequent career owed much to his mathematical master, the Reverend Henry Williams.

He entered St. John's College, Cambridge, in 1882. He was a fellow of St. John's College from 1886 to 1889 and held the Sedleian chair of natural philosophy at Oxford from 1899 on. He was elected a fellow of the Royal Society of London in 1894. Love was secretary of the London Mathematical Society for fifteen years and president in 1912-1913. He was noted as a quiet, unassuming, brilliant scholar, with a logical and superbly tidy mind. He liked traveling, was interested in music, and played croquet. He never married; a sister, Blanche, kept house for him.

Love's principal research interests were the theory of deformable media, both fluid and solid, and theoretical geophysics. He also contributed to the theory of electric waves and ballistics, and published books on theoretical mechanics and the calculus.

Love's first great work, *A Treatise on the Mathematical Theory of Elasticity*, appeared in two volumes in 1892-1893. A second edition, largely rewritten, appeared in 1906 and was followed by further editions in 1920 and 1927. This treatise, translated into several foreign languages, served as the world's standard source on the subject for nearly half a century. It is a masterpiece of exposition and stands as a classic in the literature of mathematical physics. It continues to be much referred to by workers in the field.

While Love's contribution to the pure theory of elasticity rests principally on his expository powers, his excursions into theoretical geophysics led to far—reaching discoveries about the structure of the earth. His second work. *Some Problems of Geodrnamics*, won the Adams Prize at Cambridge in 1911 The work includes contributions on isostasy, tides of the solid earth, variation of latitude, effects of compressibility in the earth, gravitational instability, and the vibrations of a compressible planet. Many of his contributions are basic in current geophysical research, especially Love waves and Love's numbers, the latter being key numbers in tidal theory.

Developing the theory of Love waves was probably his greatest contribution. Formal theory on the transmission of primary (*P*)and secondary (*S*) waves in the interior of an elastic body had been worked out by Poisson and Stokes (1830-1850). In 1885 Rayleigh had shown that waves (Rayleigh waves) could be transmitted over the surface of an elastic solid. Rayleigh's theory concerned a semi-infinite, uniform, perfectly elastic, isotropic solid with an infinite plane boundary over which the waves travel.

According to Rayleigh the only permissible surface waves under these conditions are polarized so that the SH component of the particle motions is absent; this is the component which lies in the plane of the surface and is at right angles to the direction of wave advance. A second property of the waves is that for any general initial disturbance they advance unchanged in form: there is no dispersion—no spreading out into sine wave constituents over time.

When surface seismic waves were first detected in studies of earthquake records (some time after 1900), they were found to be discordant with the above two properties of Rayleigh waves. Love set out to investigate a suggestion that the earth's crust is responsible for the discordance. He examined a mathematical model consisting of Rayleigh's uniform medium overlain by a uniform layer of distinct elastic properties and density, and found that this model both permits the transmission of *SH* waves and requires the waves to be dispersed. These waves are now called Love waves. Love was thus the first to satisfy the general observational requirements of seismology with respect to surface waves.

Love's analysis also supplied a relation between periods and group velocities of surface waves, which became a powerful tool in estimating crustal thicknesses in various geographical regions of the earth; it led *inter alia* to the first evidence of the large differences in crustal structures below continents and

BIBLIOGRAPHY

Love published forty-five research papers over the period 1887-1929. A full list is given in the *Obituary Notices of Fellows of the Royal Society*,**3** (1939–1941), 480–482.

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K. E. Bullen