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(*b*. Mézières, France, 30 June 1791; *d*. Paris, France, 16 March 1841)

physics.

Savart made experimental studies of many phenomena involving vibration. With Biot he showed that the magnetic field produced by the current in a long, straight wire is inversely proportional to the distance from the wire. In most of his vibrational studies Savart observed the nodal lines of vibrating surfaces and solids, and he thereby obtained information on vibrational modes and elastic properties.

Savart was the son of Gérard Savart, an engineer at the military school of Metz. His brother, Nicolas, who studied at the École Polytechnique and was an officer in the engineering corps, also did work on vibration. Savart studied medicine, first at the military hospital at Metz and then at the University of Strasbourg, where he received his medical degree in 1816. At this time Savart presumably was already interested in the physics of the violin, for he built an experimental instrument in 1817 and in 1819 presented a memoir on the subject to the Paris Academy of Sciences. Biot, one of Savart's first contacts in Paris, was interested in his work and helped him to find a position teaching physics there. In 1827, Savart replaced Fresnel as a member of the Paris Academy; and in 1828 he became a professor of experimental physics at the Collège de France, where he taught acoustics.

In 1820, a few months after Oersted's discovery of the magnetic field produced by a current, Biot and Savart determined the relative strength of the field by observing the rate of oscillation of a magnetic dipole suspended at various distances from a long, straight wire. In some measurements the earth's field was canceled by an appropriately placed magnet, while in others the apparatus was oriented so that the field produced at the dipole by the current was in the magnetic north-south direction.

In his earliest work Savart gave the first explanation of the function of certain parts of the violin. To learn how vibrations are transmitted from the strings to the rest of the instrument, he induced vibrations in a free wood plate by passing a vibrating string over a bridge at its center; he also used Chladni's sand-pattern technique to observe the resulting nodal lines. Savart showed that the bridge transmits the string's vibrations; that the plate can be made to vibrate at any frequency; and that the corresponding mode is a modification of an unforced mode. He demonstrated that the sound post also serves to transmit vibrations, and he explained that it therefore should not be placed under a nodal line. Thinking that symmetry and regularity would produce the best tone, Savart built a trapezoidal violin with rectangular sound holes. When the instrument was played before a committee that included Biot, the Composer Cherubini, and other members of the Academy of Sciences and the Académie des Beaux-Arts, its tone was judged as extremely clear and even, but somewhat subdued.

Over a period of twenty years, Savart performed numerous experiments in acoustics and vibration. He generalized his work on the violin to analyze the vibrations of coupled systems. He also greatly extended Chladni"s observations of the modes of plates: adding a dye to the sand, he made prints of the nodal patterns for brass plates in the shapes of circles, ellipses, and polygons. Savart was able to locate directly the nodes of a vibrating air column by lowering a light membrane covered with sand into a vertical pipe.

On the basis of his experience observing vibrational modes, Savart introduced a new way to learn about the structure of materials. The variation of nodal patterns for laminae cut along different planes of a nonisotropic material indicated the orientational dependence of the material's elasticity. ticity. Savart sought the axes of elasticity of various substances, including certain crystalline ones. His papers on this subject were translated and reprinted.

Savart also studied aspects of the voice and of hearing. In connection with determining the lower frequency limit of hearing, he devised and used the rotating toothed wheel for producing sound of any frequency. Savart was highly regarded as an experimenter, and his results were relevant for the contemporary analyses of vibration and elasticity made by Poisson, Cauchy, and Lamé.

BIBLIOGRAPHY

I. Original Works. Savart's published works include *Mémoire sur la construction des instruments à chordes et à archet* (Paris, 1819); "Mémoire sur la communication des mouvements vibratoires entre les corps solides," in *Annales de chimie et de physique*, 2nd ser., **14** (1820), 113–172; "Note sur le magnétisme de la pile de Volta," *ibid*., **15** (1820), 222–223, written with

J. B. Biot; “Recherches sur les vibrations de l’air,” *ibid*., **24** (1823), 56–88; “Mémoire sur les vibrations des corps solides, considérées en général,” *ibid*., **25** (1824), 12–50, 138–178, 225–269; “Recherches sur l’élasticité des corps qui cristallisent regulièrement,” *ibid*., **40** (1829), 5–30, 113–137; “Recherches sur la structure des métaux,” *ibid*., **41** (1829), 61–75; and “Sur les modes de division des plaques vibrantes,” *ibid*., **73** (1840), 225–273. More of Savart’s papers are listed in the Royal Society *Catalogue of Scientific Papers*, **V** (London, 1871), 419–420.

Savart began a book on acoustics but did not complete it. See *Comptes rendus ... de l’Académie des sciences*, **12** (1841), 651–652.

II. Secondary Literature. There are brief biographies of Savart in Michaud’s *Biographie universelle*, XXXVIII, 104–105; and in *Nouvelle biographie générale* (Paris, 1969), 387–389. The report of the committee that studied Savart’s *mémoire* on the violin is in *Annales de chimie et de physique*, 2nd ser., **12** (1819), 225–255. The determination of the Biot-Savart law is discussed in detail by J. B. Biot in *Précis élémentaire de physique*, 3rd ed., **II** (Paris, 1824), 707–723; this section is translated by O. M. Blunn in R. A. R. Tricker, *Early Electrodynamics* (Oxford, 1965), 119–139. Some of Savart’s work on vibration and elasticity is discussed by I. Todhunter in *A History of the Theory of Elasticity*, K. Pearson, ed. (New York, 1960), 167–183.

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