# Kirchhoff Law In Radiation

== Kirchhoff's current law == e1c2bc2891 It is an ideal emitter: at every frequency, it emits as much or more thermal radiative energy as any other body at the same temperature. e1c2bc2891 == History == e1c2bc2891 Kirchhoff's law of thermochemistry e1c2bc2891 Every physical body... e1c2bc2891 Here, the dimensionless coefficient of absorption (or the absorptivity) is the fraction of incident light (power) at each spectral frequency that is absorbed by the body when it is radiating and absorbing in thermodynamic equilibrium. e1c2bc2891 A body at temperature T radiates electromagnetic energy. A perfect black body in thermodynamic equilibrium absorbs all light that strikes it, and radiates energy according to a unique law of radiative emissive power for temperature T (Stefan–Boltzmann law), universal for all perfect black bodies. For a material that is not a perfect black body, Kirchhoff's law states that: e1c2bc2891 Thermal radiation can be used to detect objects or phenomena normally invisible to the human eye. Thermographic cameras create an image by sensing... e1c2bc2891 Real materials emit energy at a fraction—called the emissivity—of black... e1c2bc2891 Both of Kirchhoff's laws can be understood as corollaries of Maxwell's equations in the low-frequency limit. They are accurate for DC circuits, and for AC circuits at frequencies where the wavelengths of electromagnetic radiation are very large compared to the circuits. e1c2bc2891 The E20.02 was started shortly after the E20 Committee was established in 1962. e1c2bc2891 A black body at room temperature (23 °C (296 K; 73 °F)) radiates mostly in the infrared spectrum, which cannot be perceived by the human eye, but can be sensed by some reptiles. As the object increases in temperature to about 500 °C (773 K; 932 °F), the emission spectrum... e1c2bc2891 Gustav Robert Kirchhoff was born on 12 March 1824 in Königsberg, Prussia, the son of Friedrich Kirchhoff, a lawyer, and Johanna Henriette Wittke. His family were Lutherans in the Evangelical Church of Prussia. e1c2bc2891

Electromagnetic radiation In physics, electromagnetic radiation (EMR) or an electromagnetic wave (EMW) is a self-propagating wave of the electromagnetic field that carries momentum In physics, electromagnetic radiation (EMR) or an electromagnetic wave (EMW) is a self-propagating wave of the electromagnetic field that carries momentum and radiant energy through space. It encompasses a broad spectrum, classified by frequency (inversely proportional to wavelength), ranging from radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, to gamma rays. All forms of EMR travel at the speed of light in a vacuum and exhibit wave–particle duality, behaving both as waves and as discrete particles called photons e1c2bc2891

== Biography == e1c2bc2891

Gustav Kirchhoff He coined the term black body in 1860. him, which include Kirchhoff's circuit laws, Kirchhoff's law of thermal radiation, Kirchhoff's diffraction formula, and Kirchhoff's law of thermochemistry Gustav Robert Kirchhoff (German: ['gʊstaːf 'ʁoːbɛʁt 'kɪʁçhɔf]; 12 March 1824 – 17 October 1887) was a German physicist and mathematician who contributed to the fundamental understanding of electrical circuits, spectroscopy, and the emission of black-body radiation by heated objects e1c2bc2891

Electromagnetic radiation is produced by accelerating charged particles such as from the Sun and other celestial bodies or artificially generated for various applications. Its interaction with matter depends on wavelength, influencing its uses in communication, medicine, industry, and scientific research. Radio waves enable broadcasting and wireless communication, infrared is used in thermal imaging, visible light is essential for vision, and higher-energy radiation, such as X-rays and gamma rays, is applied in medical imaging, cancer treatment, and industrial inspection. Higher energy EMR, especially in the UV and above, has been associated with negative... e1c2bc2891 Of particular importance, although planets and stars (including the Earth and Sun) are neither in thermal equilibrium with their surroundings nor perfect black bodies, black-body radiation is still a good first approximation for the energy they emit. e1c2bc2891

Thermal radiation The radiation is not monochromatic, i. its temperature and its spectral emissivity, as expressed by Kirchhoff's law. The emission of energy arises from a combination of electronic, molecular, and lattice oscillations in a material. , it does not consist of only a single Thermal radiation is electromagnetic radiation emitted by the thermal motion of particles in matter. All matter with a temperature greater than absolute zero emits thermal radiation. e e1c2bc2891

Kirchhoff's circuit laws This law, also called Kirchhoff's first law, or Kirchhoff's junction rule, states Kirchhoff's circuit laws are two equalities that deal with the current and potential difference (commonly known as voltage) in the lumped element model of electrical circuits. These laws can be applied in time and frequency domains and form the basis for network analysis. They were first described in 1845 by German physicist Gustav Kirchhoff. Widely used in electrical engineering, they are also called Kirchhoff's rules or simply Kirchhoff's laws. This generalized the work of Georg Ohm and preceded the work of James Clerk Maxwell. of electromagnetic radiation are very large compared to the circuits e1c2bc2891

An ideal black body in thermal equilibrium has two main properties: e1c2bc2891

ASTM Subcommittee E20.02 on Radiation Thermometry 02's standards are published along with the rest of the E20's standards in the Annual Book of ASTM Standards, Volume 14. The subcommittee is responsible for standards relating to radiation or infrared (IR) temperature measurement. 03. 02 on Radiation Thermometry is a subcommittee of the ASTM Committee E20 on Temperature Measurement, a committee of ASTM International. E20. thermometer Kirchhoff's law of thermal radiation Planck's law Pyrometer Radiance Rayleigh–Jeans law Sakuma–Hattori equation

Stefan–Boltzmann law Thermal radiation ASTM Subcommittee E20 e1c2bc2891

== Definition == e1c2bc2891

Black-body radiation Black-body radiation is also called thermal radiation, cavity radiation, complete radiation or temperature radiation. Black-body Black-body radiation is the thermal electromagnetic radiation emitted from a body in thermodynamic equilibrium with its environment. The radiation emitted is a continuous spectrum over all possible radiation wavelengths that depends only on the body's temperature. A black body is an idealized opaque and non-reflective body. Gustav Kirchhoff in 1860 e1c2bc2891

A perfectly-insulated enclosure which is in thermal equilibrium internally contains black-body radiation and will emit it through a hole made in its wall, provided the hole is small enough to have a negligible effect upon the equilibrium. The thermal radiation spontaneously emitted by many ordinary objects can be approximated as black-body radiation. e1c2bc2891 Kirchhoff's three laws of spectroscopy e1c2bc2891 The primary method by which the Sun transfers heat to the Earth is thermal radiation. This energy is partially absorbed and scattered in the atmosphere, the latter process being the reason why the sky is visibly blue. Much of the Sun's radiation transmits through the atmosphere to the surface where it is either absorbed or reflected. e1c2bc2891

Kirchhoff's laws Kirchhoff's laws, named after Gustav Kirchhoff, may refer to: Kirchhoff's circuit laws in electrical engineering Kirchhoff's law of thermal radiation Kirchhoff's laws, named after Gustav Kirchhoff, may refer to: e1c2bc2891

The Bunsen–Kirchhoff Award for spectroscopy is named after Kirchhoff and his colleague, Robert Bunsen. e1c2bc2891

Kirchhoff's law of thermal radiation It was stated by Gustav Kirchhoff in 1860. It is a special case of Onsager reciprocal relations as a consequence of the time reversibility of microscopic dynamics, also known as microscopic reversibility. In heat transfer, Kirchhoff's law of thermal radiation refers to wavelength-specific radiative emission and absorption by a material body in thermodynamic In heat transfer, Kirchhoff's law of thermal radiation refers to wavelength-specific radiative emission and absorption by a material body in thermodynamic equilibrium, including radiative exchange equilibrium e1c2bc2891

Kirchhoff's law of thermal radiation e1c2bc2891 Kirchhoff studied at the University of Königsberg, where he attended the mathematico-physical seminar directed by C. G. J. Jacobi, Franz Ernst Neumann, and Friedrich Julius Richelot. In 1845, Kirchhoff formulated two circuit laws, which are now ubiquitous in electrical engineering. He completed this study as a seminar exercise... e1c2bc2891 It is a diffuse emitter: measured per unit area perpendicular to the direction, the energy is radiated isotropically, independent of direction. e1c2bc2891 Several different sets of concepts are named "Kirchhoff's laws" after him, which include Kirchhoff's circuit laws, Kirchhoff's law of thermal radiation, Kirchhoff's diffraction formula, and Kirchhoff's law of thermochemistry. e1c2bc2891

Planck's law In physics, Planck's law (also Planck radiation law) describes the spectral density of electromagnetic radiation emitted by a black body in thermal equilibrium In physics, Planck's law (also Planck radiation law) describes the spectral density of electromagnetic radiation emitted by a black body in thermal equilibrium at a given temperature T, when there is no net flow of matter or energy between the body and its environment e1c2bc2891

Kinetic energy is converted to electromagnetism due to charge-acceleration or dipole oscillation. At room temperature, most of the emission is in the infrared (IR) spectrum, though above around 525 °C (977 °F) enough of it becomes visible for the matter to visibly glow. This visible glow is called incandescence. Thermal radiation is one of the fundamental mechanisms of heat transfer, along with conduction and convection. e1c2bc2891

Black body ". The radiation emitted by a black body in thermal equilibrium with its environment is called black-body radiation. The name "black body" is given because it absorbs all colors of light. particularly its spectral and angular dependence. In contrast, a white body is one with a "rough surface that reflects all incident rays completely and uniformly in all directions. Kirchhoff's law of thermal radiation Vantablack, a substance produced in 2014 and among the blackest known Planckian A black body or blackbody is an idealized physical body that absorbs all incident electromagnetic radiation, regardless of frequency or angle of incidence e1c2bc2891

Kirchhoff's circuit laws in electrical engineering e1c2bc2891 At the end of the 19th century, physicists were unable to explain why the observed spectrum of black-body radiation, which by then had been accurately measured, diverged significantly at higher frequencies from that predicted by existing theories. In 1900, German physicist Max Planck heuristically derived a formula for the observed spectrum by assuming that a hypothetical electrically charged oscillator in a cavity that contained black-body radiation could only change its energy in a minimal increment, E, that was proportional to the frequency of its associated electromagnetic wave. While Planck originally regarded the hypothesis of dividing energy into increments as a mathematical artifice, introduced merely to get the correct answer, other physicists including Albert Einstein built on his work, and Planck's insight is now recognized to be of fundamental importance to quantum theory. e1c2bc2891 In slightly different terms, the emissive power of an arbitrary opaque body of fixed size and shape at a definite temperature can be described by a dimensionless ratio, sometimes... e1c2bc2891 A black body in thermal equilibrium (that is, at a constant temperature) emits electromagnetic black-body radiation. The radiation is emitted according to Planck's law, meaning that it has a spectrum that is determined by the temperature alone (see figure at right), not by the body's shape or composition. e1c2bc2891 Kirchhoff equations in fluid dynamics e1c2bc2891 Kirchhoff's theorem about the number of spanning trees

in a graph e1c2bc2891