

Abstract Submitted
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Kirchhoff's Law: Blackbody and Cavity Radiation Reconsidered.

PIERRE-MARIE ROBITAILLE, Ohio State Univ - Columbus — Kirchhoff's law of thermal emission was formulated without any experimental proof in 1859. The arguments were strictly theoretical. Yet, to this day, no theoretical proof of Kirchhoff law has survived scientific scrutiny. The law also remains without experimental verification, despite the fact that all physical laws must be confirmed by observation. According to Kirchhoff, cavity radiation must always be black, or normal, depending strictly on temperature and frequency of observation while being independent of the nature of the cavity walls. Using cylindrical cavities made by drilling a small hole into blocks of graphite, steel, copper, aluminum, and brass it becomes readily apparent that not all cavities contain blackbody radiation, unless such radiation is already present in the surroundings. Real blackbodies, represented by the graphite cavity in the infrared, can convert any incident radiation or heat energy present in their walls, to blackbody radiation characteristic of their own temperature. They do so by doing work. However, rigid perfectly reflecting cavities are unable to do work. They are unable to emit photons from their walls and thereby cannot govern the radiation which they contain. As such, perfectly reflecting cavities always become filled with the radiation incident upon them from their surroundings. The point can be echoed by examining resonant cavities used in magnetic resonance imaging (MRI), microwave communications, and laser technology. In this way, it can be demonstrated that Kirchhoff's law of thermal emission has never been valid. Cavity radiation is strictly dependent on the nature of the walls.

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