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How Ray Guns Got Their Zap

Stephen R. Wilk

Drawing on decades of optical science, H.G. Wells imagined the first ray gun in the science fiction classic *The War of the Worlds*. But it took pulp comic strip hero Buck Rogers to add a “Zap!”

A brief history of rays

The word “ray” comes from the same Latin root as “radius” and “radiate,” and implies something flowing outward from a central source. Similar words appear in the Romance languages, and the Oxford English Dictionary (OED) notes that “ray” was used from the 14th Century forward. The word didn’t become common until the 17th Century.

Early uses invariably refer to light rays. According to the OED, the first time the word was used to refer to the emanation of something other than light was in a description of “magnetick rayes” that dates from 1664. In 1814, non-visible electromagnetic rays were first mentioned as “rays transmitted from the sun that do not illuminate.”

But what really started the ball rolling was the work of Julius Plücker, professor of Mathematics and Physics at the

University of Bonn. He explored the phenomena of gas discharges in nearly evacuated tubes subjected to electrical stimulation. His tubes were made by master glassblower Johann Heinrich Wilhelm Geissler, who coined them as “Geissler Tubes”—a name that has stuck over the years. Plücker found that gas discharge seemed to proceed from particular points on his cathode. If he reduced the cathode to a point, the output seemed to radiate from this point, similar to light beams.

Plücker thus became the first to call this new phenomenon “rays,” or *strahlen*.

Johann Wilhelm Hittorf, working at the Royal Academy of Münster in Prussia observed in 1869 that *kathodestrahlen* could cast shadows if an object were interposed between the cathode and the fluorescing screen, indicating rectilinear propagation in straight lines. He called these “glow rays” (*glimmstrahlen*). It seemed that new and exotic rays were cropping up everywhere.

Study of the new rays proceeded in many places. William Crookes—an independent researcher—found that they could be deflected by magnetic and electric fields, implying that the beam consisted of charged particles. In 1886, Eugen Goldstein of the University of

Berlin bored a hole in the cathode of a Crookes tube and found a new ray streaming in the opposite direction. Because

the rays went through the channel, they were called *kanalstrahlen*, or “channel rays.” The opposite direction of streaming implied that this was a beam of particles having the opposite charge of the cathode rays.

On November 8, 1895, Wilhelm Roentgen at the University of Würzburg covered his Crookes tube in black paper to block light from entering. He then placed a screen of fluorescent barium plantinocyanide beyond the end of the paper-wrapped tube. When he connected the leads of the induction coil, starting a discharge, the screen nevertheless glowed. This indicated that invisible rays had penetrated the glass walls and the paper. After six more weeks of work, Roentgen presented a paper at the December meeting of the Würzburg Physico-Medical Society, announcing a new and invisible form of radiation called X-rays.

Within months, natural radiation was discovered by Antoine Henri Becquerel



Disintegrator – In SF terminology, one of the commonest items in the SF armoury, especially in Space Opera of the 1930s and ‘40s. It may have resulted from a certain squeamishness, since it allows for a maximum of destruction with a minimum of bleeding pieces to sweep up afterwards.

— Peter Nicholls, *The Science Fiction Encyclopedia*

of the École Polytechnique in Paris. He acted on the ideas of Roentgen and Henri Poincaré, who suggested that fluorescent materials might be particularly good for producing X-rays. Three years later, Rutherford noted that the radiation had at least two components, which he called alpha rays and beta rays. The following year, Paul Villard of the École Normal of Paris noted the existence of gamma rays—a third, far more penetrating component that could not be deflected by electromagnetic fields.

Around 1914, V.F. Hess and W. Köhllhorster of Germany discovered another type of ray. They were conducting experiments with balloons to observe how the ionization of the atmosphere varied with altitude. After ionization decreased initially with increasing height, it then began to increase rapidly with altitude. The researchers postulated an extraterrestrial origin for the phenomenon, and called the rays *höhenstrahlung* or *ultrastrahlung*. Robert Millikan coined the equivalent term in English in 1925—“cosmic rays.”

By the early 20th Century, many so-called rays came to be recognized as what we now call “particle beams.” Alpha rays are helium nuclei, and beta rays are electrons. Of the three forms of Becquerel’s radioactivity, only gamma rays proved to be electromagnetic waves. Cathode rays were shown to be electron beams; channel rays became beams of positive ions; and cosmic rays were later proven to be high-energy particles along with high-energy photons.

Over time, “ray” came to refer only to directional electromagnetic radiation; other phenomena, such as disturbances in nuclear forces, are now termed “waves.” (Some papers still refer to “alpha rays” and “beta rays” to indicate the source of radiation, but “alpha particles” and “electrons” are used just as commonly.)

The birth of the ray gun

By the late 1800s, it was clear that the world was filled with strange, light-like rays. As these rays increasingly shaped scientists’ research agendas, they also captured the imaginations of science fiction writers.

Herbert George Wells began publishing science fiction in 1895. Within three years, he had already published eight books, including the classics *The Invisible Man*, *The Time Machine* and *The Island of Doctor Moreau*. For his next work, *The War of the Worlds* (1898), the mighty British Empire was attacked by a technologically superior enemy from Mars. The book contained the first fictional account of an alien invasion. Wells produced an amazingly detailed vision that contained grotesque Martians and strange technologies, including Tripod tanks, poisonous black smoke, and weapons that fired invisible “heat rays” that instantly incinerated their targets.

Wells was clearly inspired by the discoveries of the day, particularly that of infrared light. Indeed, in Chapter 6, he imagines a kind of infrared searchlight:

Many think that in some way they [the Martians] are able to generate an intense heat in a chamber of practically absolute nonconductivity. This intense heat they project in a parallel beam against any object they choose by means of a polished parabolic mirror of unknown composition, much as the parabolic mirror of a lighthouse projects a beam of light.

His description was prescient. A century later, those words could be used to explain the operation of an industrial CO₂ laser.

Jules Verne—arguably the inventor of modern science fiction—was the next to incorporate a new type of ray into his work. In *The Hunt for the Meteor*, which was published in 1908, the character Zephrim Xirdal creates the “Neutral Helicoidal Ray,” which is apparently the first tractor beam to appear in science fiction. This ray can draw objects toward the projector, and Professor Xirdal uses it to bring to earth a meteor made of solid gold. He reverses the beam before the meteor lands, however, after he sees the corrupting influence of people’s greed for the gold.

Soon, rays began appearing regularly in the pages of science fiction. George Griffith’s 1911 novel *The Lord of Labour* describes a future war fought with atomic

missiles and disintegrator rays. The weapon in *The Zeppelin Destroyer* (1916) by William le Queux was a ray gun, and Percy F. Westerman's 1923 novel *The War of the Wireless Waves* pitted British "ZZ" rays against German "Ultra-K" rays. The bad guys in E.E. "Doc" Smith's 1928 proto-space opera *The Skylark of Space* used infra-sound rays, heat rays, ultraviolet rays, and "induction rays" (whatever they might be).

The relentless efficiency of ray guns seems to touch a nerve in readers—then as well as now. Indeed, according to Peter Nicholls' 1979 *Science Fiction Encyclopedia*, the disintegrator "may have resulted from a certain squeamishness, since it allows for a maximum of destruction with a minimum of bleeding pieces to sweep up afterwards."

Ready, aim...zap!

Real rays don't make noise. The word "zap" better describes the noise made

by an electrical discharge, like a Jacob's Ladder or a Tesla Coil. Both the sound and the light in such cases are caused by the recombination of ionized nitrogen in the air, rather than by any sort of ray. The word was adopted in the world of science fiction because it adds a satisfying sound to a ray gun's action.

The first use of "zap" in science fiction appears to be by P.F. Nowlan: "Ahead of me was one of the golden dragon Mongols, with a deadly disintegrator ray...Br-r-rr-r-z-zzz-zap." The quote is from Nowlan's story "Armageddon 2419 A.D.," which appeared in the pulp sci-fi magazine *Amazing Stories* in 1928. (It might possibly be from the sequel, "The Airlords of Han," which appeared in the same magazine.)

Although Nowlan's works weren't collected and published in book form until the 1960s, they were almost immediately adapted as color comic strips due to their popularity and dramatic visual potential.

Nowlan's story of Anthony Rogers, who falls asleep and awakens half a millenium later to find that alien Mongols have taken over North America, translated very well into comics. Rogers joins the underground resistance to fight the Mogols with superscientific weaponry.

The hero's name was changed for the comic from Anthony to the more folksy and plebian "Buck." Buck Rogers was immensely popular, and he inspired similarly named heroes like "Brick" Bradford and "Flash" Gordon; the latter borrowed shamelessly from Rogers, from the Mongols to the faux-Oriental Emperor Ming...right down to the zap!

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Further Reading

1. P.F. Dahl, *Flash of the Cathode Rays: A History of J.J. Thomson's Electron*, Institute of Physics Publ., Bristol/Philadelphia, 49-57 (1997).
2. E.H. Kennard et al. *Introduction to Modern Physics*, Fifth Ed. McGraw-Hill, 455 (1955).