Let there be invisible light

The universe is filled with light that we cannot see.

by Elizabeth Palmer

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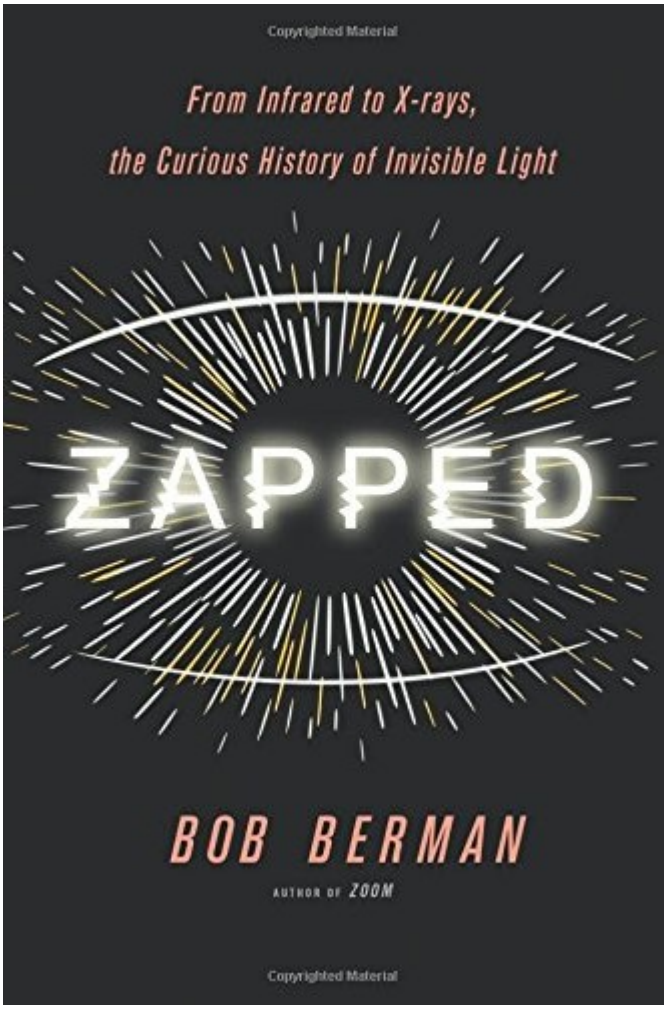
In Review



Zapped

From Infrared to X-rays, the Curious History of Invisible Light

by Bob Berman
Little, Brown and Company

It wasn't the chapter on total solar eclipses that convinced me to read this book, nor was it the book's claim to tell the story of "all the light we cannot see" (a claim that is at once audacious and subliminally heart-tugging for those who have read the novel of that name). It was the wry humor in the first sentence: "If God really did say, 'Let there be light,' it was no small housewarming present." The author, astronomer Bob Berman, continues: "There is a *lot* of light in the universe—one billion photons of light for every subatomic particle. . . . The universe is literally made of light. And that includes not only ordinary everyday visible light but also the vast majority of light—the kind we *cannot* see. Light is an astonishing entity."

Until reading that paragraph, I hadn't considered God's creation of light in such an expansive way. I'd always imagined that the instant that God spoke into the darkness, all the colors of the rainbow emerged. But according to Berman's reconstruction of the scene, so did ultraviolet light and infrared radiation, radio waves and microwaves, x-rays and gamma rays. (This still doesn't clear up the mystery of how there could be light on the first day of creation when the sun, moon, and stars weren't created until the fourth day. Thankfully, neither Berman nor I is a biblical literalist, so we can leave such questions behind.)

The most delightful aspect of this book is the contagious sense of awe that the author conveys. Berman is pure scientist, an astronomy nerd in the most endearing sense of nerdiness. His focus is on the stories of how some remarkable scientists unfolded the mysteries of various forms of invisible light and how that light influences our lives and our health today. But he's not afraid to marvel at the *gravitas* of his subject matter. Writing about cosmic microwave background radiation, a faint microwave hum that seems to be leftover from a cosmic "big bang" 13.8 billion years ago, Berman concludes:

> The ultimate reason for the big bang, or even an accurate (or approximate) description of it, is unknown. A universe popping out of empty space offers no hint of any antecedent conditions, no clue of what may have precipitated such an astonishing occurrence. Thus the all-

> pervasive invisible background microwaves provide some clarity about the enormous mystery of cosmic genesis—while presenting an equally big enigma at which we can only shrug in wonder.

This same sense of wonder appears in the midst of Berman's tale of Ernest Rutherford, who in 1911 created a model of the atom based on his experiments with alpha rays. Rutherford, noticing the unexpected deflection of a small proportion of the rays when fired at a thin gold plate, concluded that "all the positive charge and essentially all the mass of the atom is concentrated in an infinitesimally small fraction of its total volume." To equal the density of protons and neutrons, Berman goes on to explain,

> you'd have to crush a cruise ship down until it was the size of the point in a ballpoint pen. Imagine a sphere smaller than a mustard seed, weighing what a cruise ship does and containing every ton of its steel. Seems impossible, right? And yet that exact density exists in each of the one hundred billion billion billion protons and neutrons in each of our bodies.

That's an image that preaches, and not just because of the mustard seed reference. It's a scientific correlate to Martin Luther's theological conviction that the finite holds the infinite (*finitum capax infiniti*). In a piece of bread or sip of wine, there is infinite grace. From five loaves and two fish, Jesus can create a feast that feeds thousands. Into our limited, fallible words and actions, the Spirit infuses traces of redemption, joy, forgiveness, and justice.

None of this theology is even hinted at in Berman's book, nor should it be. It's a science book through and through. But the author's openness to mystery and contagious sense of wonder make the book a great conversation partner for people of faith who want to learn more about our invisible (and very powerful) surroundings.