LETTERS

Respect for a master's in physics

With regard to Toni Feder's story about physics master's degrees (PHYSICS TODAY, April 2019, page 22), I am glad that the degree finally seems to be getting some respect. I received my master's 30 years ago from a PhD-granting research university. Although I had been accepted to continue toward my PhD, I intended from the beginning to pursue only a master's and then look for teaching positions. I remember being told, "That and a dime will get you a cup of coffee," and I often received unsolicited advice that I would be useless to the profession without a PhD.

Partly on the suggestion of my adviser, who counseled me to think about the goals I'd had when I entered graduate school, I accepted a one-year position as a visiting lecturer at a nearby branch campus. That job led to a tenure-track position at a nearby community college the next year. There I had a professionally and materially satisfying 27-year career teaching and doing research.

For reasons mostly my own, I did eventually complete a PhD and a postdoc and have recently found myself as a lecturer back where I got my MS. I hope to stay until I retire. I have no regrets about what I've done and how I did it and perhaps just a bit of pride in how much I accomplished with my master's degree, despite what I was told.

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Notes on a brilliant failure

The article "Ernest Lawrence's brilliant failure" by Joshua Roebke (PHYSICS TODAY, March 2019, page 32) gives a historical account of early work by the Nobel recipient and his associates at the University of California, Berkeley, to invent color TV. An alumnus of both Berkeley and the TV industry (1964–2006), I was surprised and pleased to learn of that work. I had not realized that Sony's Trinitron technology traces its origin back to Berkeley and Lawrence.

However, I was shocked by several inaccuracies. The article is misleading regarding the basic principles of the color

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CRT (cathode-ray tube), and it does not present an accurate account of the pre-flat-panel display industry.

The article claims that Sony's Trinitron CRT was the best-selling television in the world and was the color TV most Americans grew up with. That is incorrect. From the beginning of color broadcasting in 1954 to the mid 2000s, RCA's color CRT was the dominant one.

Sony's Trinitron was commercially introduced in 1968, 14 years after the start of the color TV industry. Virtually no other company manufactured color TVs with Trinitron displays. During the pre-flat-panel color TV era, Sony sold fewer than 300 million color TVs with Trinitrons; the rest of the industry globally sold well over 10 times as many sets with the RCA color CRT. Although RCA only manufactured in the US, it licensed its technology abroad; in several cases RCA provided direct engineering support for licensees' manufacturing plants. All color TV manufacturers worldwide, including Sony, were RCA licensees.[1]

The fundamental physical principles of the Sony and RCA color CRTs were identical. Both used three intensity-modulated electron guns to carry the three-color image information. Contrary to the article, the Trinitron did not use a single source for the three beams.

The beams were scanned by a common magnetic deflection system. In both the Sony and the RCA devices, a metal mask with small openings was placed at a precise distance between the screen and the electron guns. The beams emerged from each opening at slightly different angles and landed on the screen at three slightly displaced, nonoverlapping locations, where a trio of red, green, and blue light-emitting phosphor elements were positioned. To prevent the excitation of adjacent phosphor elements, the mask transmission is necessarily restricted to less than ⅓.

The Sony and RCA approaches used differently shaped masks. Sony's was made of tensioned metal strips forming a vertical standing cylinder. RCA's mask was best described as spherical. Thus the Sony guns were arranged horizontally, whereas the RCA ones had a triangle configuration. Both systems worked well. The price of color TVs was determined by the cost of the CRTs, which was mainly driven by the cost of their glass bulbs. Because the RCA approach was somewhat less expensive, it dominated the consumer market.

Reference

1. J. A. Castellano, *SID Symp. Dig. Tech. Pap.* **30**, 356 (1999); A. Monchamp et al., *Cathode Ray Tube Manufacturing and Recycling: Analysis of Industry Survey*, Electronic Industries Alliance (2001).

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▶ **Roebke replies:** I'm thankful that Istvan Gorog read my article until its end; he was, he confessed, pleased rather than shocked until its final paragraphs.

I did not write a history of the color television industry. My article told the story of one unheralded company and the physicists who worked on its color televisions, in their spare time, while building particle accelerators for both national defense and empirical pleasure. It was the story of the Chromatron, not RCA and the Trinitron.

Gorog was not just an alumnus of the TV industry. He was a director at RCA. So he objected when, in my denouement, I mentioned that the Trinitron was the best-selling television when most of us were growing up. In the 1990s, when I was growing up, it was.

In his letter, Gorog conflated tubes and televisions. But the first was mere synecdoche for the second. Sony built televisions from its tubes. RCA often licensed those components to other television manufacturers, so as not to manufacture all those televisions itself.

Gorog also demurred when I noted that the Trinitron had a single beam source. But it originally had a single electron gun. In the 1970s Sony even advertised "The Beauty of One Gun" as the Trinitron's distinctive feature. The veracity of my supposed inaccuracies is well documented.

Gorog then recapitulated what I wrote about grids and masks, albeit more technically and for the Trinitron rather than the Chromatron, which was the subject of my article. He distinguished the specifications of the Trinitron and RCA's tubes fluently. But he was an expert on such tubes when I was still sitting at home and watching television.

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