an interesting background of the innovative show. As a child, I watched the show regularly, and I received a *3-2-1 Contact*–branded optics exploration kit as a gift one Christmas. I clearly remember aligning the mirrors of a periscope and exploring color combinations with a spinning wheel.

Working as an optical engineer a few decades later, with the opportunity to contribute to such historic efforts as the *James Webb Space Telescope* currently scheduled to launch on Halloween of this year, I frequently think back to that influential kit and show. My sincere hope is that organizations such as PBS and Sesame Workshop continue to receive the funding necessary to inspire our future engineers and scientists.

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A note on dielectrophoresis

A story about dipole molecules in liquid (PHYSICS TODAY, April 2020, page 17) has prompted me to share some of my own experiences.

When an electrically polarized object, like a dipole, is in a nonuniform electric field, it experiences a force. That phenomenon is known as dielectrophoresis. It is possible to create a field with constant, nonzero second derivative. A dipole particle in such a field would experience a constant force that can thus be made to move in a fixed direction under a constant force.

I created such a field in a shallow device I had made at glass manufacturer Owens-Illinois, my employer, and used yeast and blood cells to study it. The cells did not move unless the field had a frequency of at least 1 MHz. I did not try much higher frequencies. In 1975–76 I took my experiment to the hematology laboratory of Massachusetts General Hospital. Unfortunately, the hoped-for dispersion of velocities among cell types was not observed, and the study ended.

However, water molecules themselves have a dipole moment. When polarized light was passed vertically through the horizontal device, applying the 1 MHz field would switch the transparency on and off.

Apparently, the yeast or blood cells were passively carried along a current of water, driven by the nonuniform field. It is a mystery why there was no motion of the cells (yeast or blood) until the frequency was increased to 1 MHz. Perhaps clusters of water molecules, which are imagined to explain the high boiling point of water, are not dipoles, and the field at or above 1 MHz breaks up some of the aggregates, allowing the dipole moment of H_2O to be sensed.

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Chasing a power supply in Siberia

Arthur Liberman's Letter to the Editor on Cold War particle-physics collaborations (PHYSICS TODAY, October 2020, page 12) reminded me of a visit I made in 1969 to Akademgorodok, a small research town near Novosibirsk, Siberia. At that time our Northeastern University research group had theoretically postulated, and done an initial experiment on, ρ–ω interference in the leptonic decay mode.[1] There were several interesting features to be experimentally or theoretically studied, and a flurry of work followed. We sought to do definitive experiments at the well-suited colliding-beams accelerator in Gersh Budker's research facilities in Akademgorodok.

During discussions with the facility's director, Veniamin Siderov, concerning the proposed experiments, we compared the structure of the Novosibirsk research group with that of the Northeastern group. The numbers that emerged gave significant insight to the hurdles faced by physics researchers in the Soviet Union.

Northeastern's high-energy research group consisted of five PhDs and seven support technicians. When I requested that Siderov provide comparable information about his facility, he replied that he had 2000 technicians. I assumed that he had misunderstood my question, but he actually did have that many technicians working for him. To help me understand the staggering difference, he described the procedure he would follow when he needed, for example, a power supply.

In the US one would simply go out and buy a power supply, but such devices were not available on the Soviet market, and Siderov had no access to hard currencies. He would have to set up a production line in a subgroup of his 2000 technicians, and they would produce perhaps 100 power supplies. He would then act as a vendor of the devices—for several years if need be—to support his technicians and make purchases of his own from other similar manufacturing centers. The amount of organization, energy, and manpower required to obtain a power supply was staggering.

I had come prepared to discuss the details of the proposed experiment, but Budker was already expert in the details of ρ–ω interference. Instead he wanted to discuss the proposed experimental setup—in particular, the number of photomultiplier tubes and power supplies. He agreed to make the accelerator available for the proposed experiment on one condition—that after completion of the measurements, the equipment would be left at his lab.

I carried that proposition back to my supporting agency, which had previously supplied support for Soviet experiments in the US. However, the arrangement was not approved; it amounted to the US paying for Soviet beam time while Soviet researchers got US beam time for free.

Reference

1. R. G. Parsons, R. Weinstein, *Phys. Rev. Lett.* **20**, 1314 (1968).

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