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coin-flipping. Coin-flipping gives you a 50-50 chance of being right. With faith you have no idea how often you may be right or wrong. Faith is not a guide to truth, and principles accepted by faith are not a proper guide to action. Faith should be condemned as an improper method of using one's mind.

Creative insight and intuition can lead to useful hypotheses, but belief requires proof of the correspondence with existence by a process of reason. No other tool exists. Physicists should lead in advocacy of reason as the sole method one has to acquire knowledge.

ROBERT H. HARTFORD
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THE AUTHOR COMMENTS: How does one account for the vast practical achievements in art, science, applied ethics, and so on, of those inspired by religious faith, if faith is unrelated to reason, as Hartford alleges? "Thou shalt not kill" is an article of religious faith. Is it therefore just a lucky strike? May the claims of reason sometimes be understated and have to be searched out in the way researchers are always finding rewards in unlikely places?

LAWRENCE CRANBERG
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Advent of 10^6 V x-rays

I was surprised and pleased to see myself in a photograph with Charlie Lauritsen on page 44 in July. We are shown beside our million-volt x-ray tube in the High Voltage Laboratory of Caltech in 1928. But the material taken from Millikan's papers does not go back quite far enough to include the start of the story.

In June 1927 I finished the first year of a National Research Fellowship at Princeton. That year had been spent in measuring the limitations of Geiger point counters. I had been working with these counters in 1924–1925 in my doctoral research at the University of Chicago. My research also used a 250-kv x-ray tube, and I wondered why no one had made use of one of the million-volt transformer banks then available to see how electrons behaved when their mass was more than doubled relativisticly as it would be at a million volts. Having pretty well exhausted the possibilities of point counters, I asked to have my second fellowship year at Caltech where one of these million-volt sets was located.

My request was granted and I was duly welcomed at Caltech by Millikan. My bed had slid across the floor in an earthquake the night of my arrival. I paid little attention, assuming it to be the daily jiggle. Had I run out in the

street I would have made the acquaintance of all the neighbors. I worked through the fall and early winter on a scale too modest, using a hot filament tube between two yard-size hemispheres.

As the PHYSICS TODAY article points out, Charlie Lauritsen was finishing his doctoral research at that time and was looking about for a new endeavor. He showed interest in what I was doing and, with his engineering experience, had a better concept of what a million-volt x-ray tube would have to look like. It was easy to agree with his concept, and Charlie "moved in" with me and my project. The scale of the operation increased about an order of magnitude, each of us providing ideas as we went along. The 1928 photograph shows the tube about a foot in diameter and ten feet long, with four glass sections butted together and mounted in a discarded transformer platform (redwood never gets dry enough to insulate a million volts).

The cathode was a steel tube about 2 inches in diameter ending in a hemisphere on which was mounted a tungsten rod about $\frac{1}{4}$ in. by 2 in. This put the anode and cathode about an inch apart. Charlie had learned a lot about pulling electrons out of metal with a high field.

The tube was based on a flat steel plate from which the diffusion pump was hung. The pump was of steel, homemade and 4 inches in diameter, connected with a liquid air trap, both very "outsize" for 1928. The pump had a steel waterjacket, and one of my memories is seeing Charlie trying to solder leaks in the waterjacket with an oxyacetylene torch. He succeeded!

The transformers were in series, all but the first on insulating stands, the redwood having been replaced with porcelain insulators. One transformer and half of the next are visible in the 1928 picture. The transformer bank was rated at 1000 kilowatts, so we had an ampere to work with. Arcs fifteen or twenty feet long were not unusual.

We got bursts of x rays, several to a half cycle, when we were able to get a good vacuum. Our regular work day was from nine in the morning to midnight and usually terminated with a hamburger "all the way" at Joe's on Colorado Street. At night we could see how we were doing by one of us taking the fluoroscope outside and seeing how far from the lab we could see the screen glow. A hundred yards marked a good night.

The control desk for the transformers is in the foreground in the 1928 picture. We moved it into a utility tunnel when we found how well we were doing, and ran the tube only when the area was deserted. We made a rough measurement of the hardness of the x rays by absorption in lead. They

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were probably the hardest seen to date. We wrote a report which appeared in *Phys Rev* **32**, pp. 850–857 (Dec. 1928).

We will never know whether Charlie would have interested himself in high-voltage x rays had he not seen me working on the problem next door. Our paper has his name first because I do not like to argue, settled for a coin toss, and lost. If I ever knew about the patent I had forgotten it. Physicists did not have much interest in patents in those days.

RALPH D. BENNETT
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8/81

Human rights in Latvia

On behalf of the Latvian Association in the United States, I would like to express our appreciation to the American Physical Society for supporting the human rights issue. Andrei Sakharov's article in the July issue was particularly welcome. I would like to call your attention to one aspect of human rights violations in the Soviet Union and Eastern Europe that has not been touched upon. Examination of the names of "dissidents" under arrest listed in Sakharov's article reveals that a highly disproportionate number of them are Estonians, Latvians, Lithuanians, Ukrainians, and Jews; 14 percent of those named in the article come from the Baltic States, while the Balts represent only less than 2 percent of the total population. This fact clearly demonstrates how the Soviets deal with their "nationality problem." It also demonstrates that brutal treatment by the Soviets will not discourage Estonians, Ukrainians and others from speaking out against their tyrant.

The fear of the idea of freedom spreading from Poland to surrounding lands has led to a sharp escalation of human rights violations in the Baltic States. Added to Sakharov's long list of imprisoned scientists can be the names of Janis Bumeistars, a Latvian electrical engineer, and Vytautas Skuodis, an American-born Lithuanian geological engineer. Bumeistars, a recognized expert in his field and author of numerous technical publications, was sentenced to 15 years in prison for treason. He was accused of being a CIA agent! Skuodis, protesting the oppression of religious rights and the continuing Soviet occupation of Lithuania, was sentenced to a seven-year term for "anti-Soviet agitation and propaganda." (The Baltic States of Estonia, Latvia and Lithuania gained their independence in 1918. However, in 1940 they were forcibly occupied and illegally incorporated into the Soviet Union. This action was precipitated by the Stalin-Hilter "peace pact" signed in 1939 whereby much of Eastern Europe was divided up among the two tyrants. The United States and most Western nations have not recognized the illegal annexation.) Skuodis is the second Balt who recently has gone on a hunger strike. Yuri Kukk, an Estonian scientist, died in a Soviet prison several months ago.

It is not only our social responsibility as scientists to speak out against these crimes against humanity, as Sakharov points out, but it is also a moral one. It is our hope that other technical societies and institutions follow your fine example.

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8/81

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International development

The American Physical Society recently established a Subcommittee on International Scientific Affairs (SISA) of its Panel on Public Affairs. SISA, under the chairmanship of J. William McGowan, organized a workshop under the title "The Focus of Physics on Science and Technology for Development" which was held 16–19 October 1980 at Baddeck, Nova Scotia, Canada.

For this meeting the APS invited around 30 physicists from developing countries to discuss—with colleagues from the US and Canada—ways to help the physics communities in developing countries to advance the knowledge of physics in their own countries. The participants of the workshop, members and nonmembers of the APS, agreed on 22 specific recommendations to the APS, which were unanimously accepted by the APS Council and thereby became the first program of action for the society in the area of physics and development.

If there were an active network of international contacts between physicists, many of the Baddeck recommendations could be carried out by members of the society on the basis of voluntary work, without the need of large external funding. Other such "low-cost" programs could be found and carried out as well.

Some of the APS members participating in the workshop felt that such a network could be organized within the APS, based on the nearly 5000 members of the society who live outside the US, in 100 countries. About 600 of these members live in developing countries.