

The Future is In the Sun

Armenia's Cosmic Ray Division Goes Where No Man Has Gone Before

Currently there are two different approaches to monitoring and forecasting the severity and impact of imminent solar radiation storms. A space-based approach is championed by NASA, and is funded by the US government and US tax dollars. The second is a ground-based system to study the same kinds of particles, such as at the Cosmic Ray Division (CRD) of the Yerevan Physics Institute, in Armenia. The CRD depends on donations channeled through the Fund for Armenian Relief's Armenian National Science and Education Fund (ANSEF).

Even though the support bases are incomparably unmatched, the quality of research that the two produce is not only equal, but also absolutely complementary. First, there are no other ground-based research centers working on this area of cosmic ray research. NASA's system to devise these alert systems using satellites is not as reliable, say some scientists, because their stations can't be as big as ground-based stations – on Armenia's Mt. Aragats, each ground-based station covers a square kilometer area. But more importantly, the satellite itself goes on standby when it senses damaging particles approaching, and so it can't alert other satellites.

Anahid Yeremian of Stanford University, a specialist in accelerator physics (see accompanying article on CANDLE) has been working with CRD to enhance their international contacts, and has helped with proposal writing and submissions. She explains the value of CRD's research.

"CRD's research is of both theoretical and practical interest. The data collected at the two high altitude observatories – one at 2,000 meters (just above the Byurakan Observatory) and a larger one at 3200 meters – is analyzed using sophisticated mathematical methodology and software developed by the CRD's Ashot Chilingarian," she says.

And this data has practical, immediate and commercial implications. Satellites, for example, depend on the flawless functioning of their high-technology systems to be able to gather or dis-



View of the CRD station on Aragats.
Photo by Mkhitar Khachatryan.

Cover Story



CRD director Ashot Chilingarian, with Nerses Gevorgian, and Gagik Gharagyozyan in the CRD control room on Aragats. Photo by Mkhitar Khachatryan.

tribute data. "Yet, solar radiation storms caused by violent explosions on the sun can unleash intense fluxes of charged particles which often adversely affect the normal functioning of satellites by disrupting space-borne electronics, and endangering space station crews," Yeremian explains. Depending on their energy, these particles can reach the earth within 10 minutes to several hours after explosions on the sun.

Professor Chilingarian, 52, CRD Director, says that with their data and analysis techniques, he can send alerts on the arrival of the harmful particles from the sun about a half hour before damaging fluxes of particles reach the earth. This allows sufficient time to shut down the electronics on satellites, take protective measures on ground-based power grids and warn airlines scheduling flights over the poles. Thus, the data from Mt. Aragats is an important piece of the puzzle cosmic ray physicists all around the

world are trying to put together.

The CRD conducts this research in partnership with such international research organizations as NATO and the International Science and Technology Center, with offices in Moscow, and funded by the US, Europe and Japan, to employ scientists who used to work on weapons research in the USSR.

The CRD's sites have been working uninterrupted since 1943, when they were set up by the same Alikhanian Brothers who established the Yerevan Physics Institute. Their collaborators include scientists in Japan, Switzerland and others from around the world. Their web site <http://crdlx5.yerphi.am> is the first among cosmic ray research stations around the world to broadcast their data online in real time. Chilingarian himself says, "If the CRD didn't exist, and we had to recreate it today, we couldn't."

Yet, this example of success-against-all-odds was having a hard time paying its staff

and meeting its overhead. With stations at various elevations around the country, the CRD's 100-person staff includes bulldozer drivers, cooks, guards and other technical support personnel. In addition, transportation and repair bills are high. Electricity bills are higher.

When Yeremian, a Yerevan-born scientist went back to Armenia in 1999, after being away for 30 years, she wanted to find colleagues and see what the state of scientific research was. It didn't take her long to meet the staff of CRD and volunteer to help.

"I had done a lot of proposal writing for Boeing, for Stanford. So I helped them with language, with format," she says. "And they're not afraid to ask for help. They know what they're good at, and what they're not."

But what she mostly helped them with was finding sources of funding. "I approached Tavit Najarian of the Fund for Armenian Relief (FAR) and explained the need, and FAR basically saved them," she explains. "I said to Edgar Housepian, on ANSEF's board, 'You cannot imagine how much you've done.' Essentially, the Diaspora is supporting salaries and operational expenses, so that this world-class center can continue to seek funds for specific research projects that have universal value." A support group was also set up, based in the Boston area, headed up by Joe Dagdigian, 60, a software engineer.

Since then, through ANSEF (and also through the Armenian Engineers and Scientists of America, in Glendale, California) donations are being collected and channeled for the CRD's annual \$40,000 in overhead expenses.

"Armenia's economy, intellectual development and security depend on its participation in and contribution to world science," says Dagdigian

