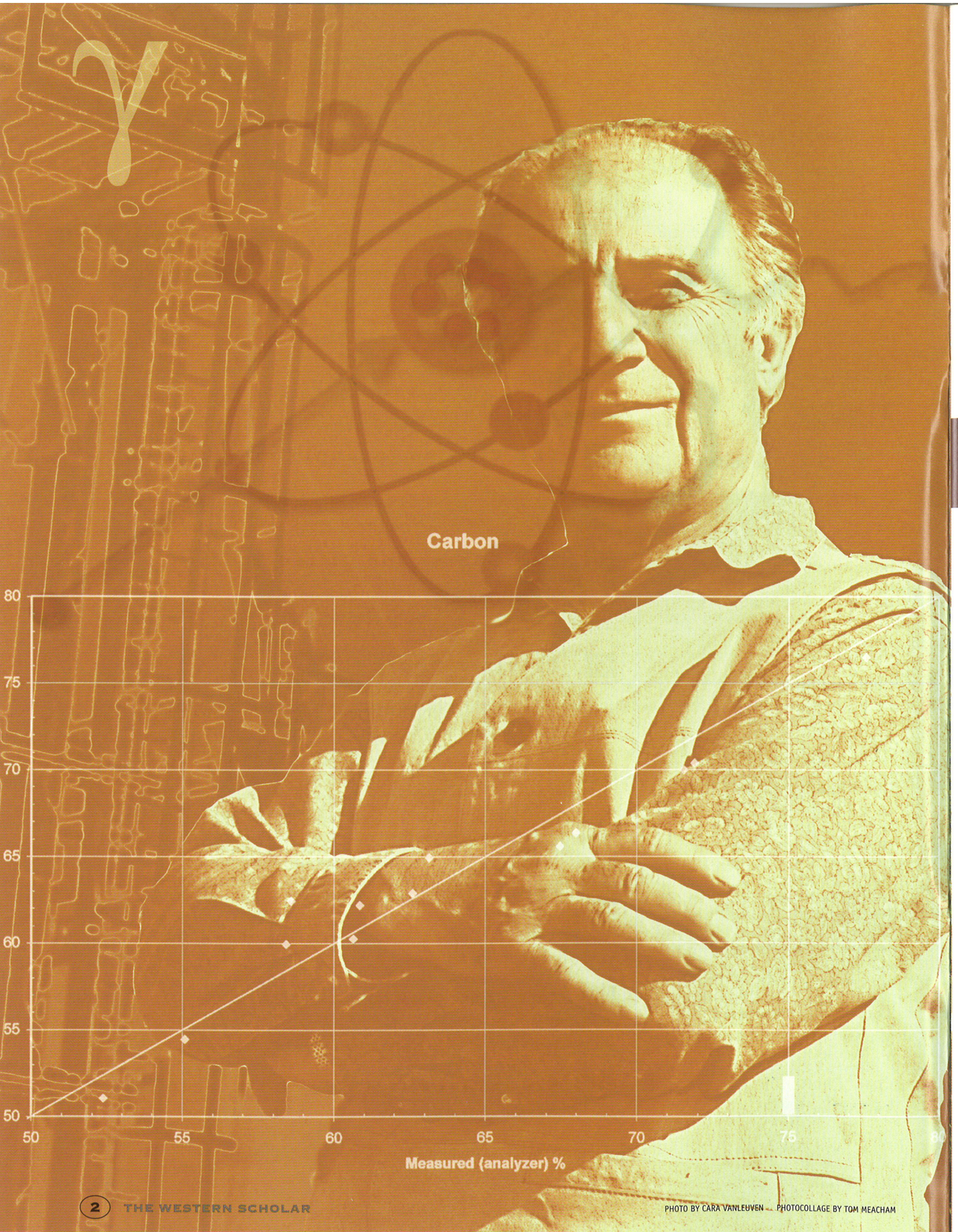


PHOTO BY CARA VANLEUVEN PHOTOCOLLAGE BY TOM MEACHAM

Check your local phone book and chances are you won't find the name Vourvopoulos listed very often. Click on your favorite Internet search engine, however, and you'll find in some ways Vourvopoulos is a household name.

A PENETRATING ANALYSIS OF EVERYTHING FROM

MR. NEUTRON

BY TOMMY NEWTON

COAL TO HIDDEN EXPLOSIVES AND ILLICIT DRUGS

George Vourvopoulos is director of Western Kentucky University's Applied Physics Institute (API). In the past decade, he and API have made quite a name for themselves in the area of elemental analysis.

"We have acquired expertise in being able to identify chemical elements within an object without touching the object or without opening the object," Dr. Vourvopoulos said.

The technique is called non-intrusive, non-destructive inspection and uses a pulsed-neutron emitting probe to analyze elemental composition. Western's Applied Physics Institute is working on three main research projects: coal analysis, detection of explosives, and detection of illicit drugs.

"The common part of all three projects is that we can identify their chemical elements without seeing or touching the object," he said. For example, using equipment developed by Western researchers, Dr. Vourvopoulos could determine whether a regular cola or diet cola was inside a box. Not only do the beverages taste different, they have a different chemical makeup, he said.

"We can identify and measure the chemical elements," he said. "We can tell the difference between dynamite and TNT."

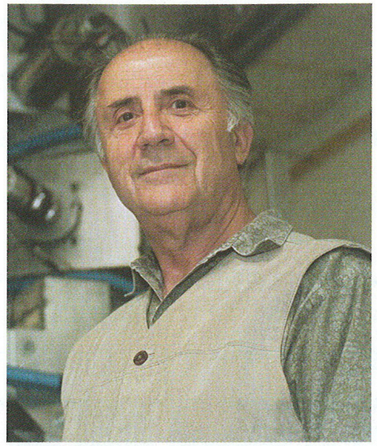


PHOTO BY CARA VANLEUVEN

The system bombards a sample with pulses of fast and slow, or thermal, neutrons. Fast neutrons collide with some atoms, triggering the release of gamma rays. Between pulses, thermal neutrons are captured by other atoms, causing emission of gamma rays. Gamma-ray fingerprints permit accurate determinations of concentrations of hydrogen, carbon, oxygen, nitrogen, sulfur and other elements in samples.

DR. VOURVOPOULOS COULD DETERMINE WHETHER A REGULAR COLA OR DIET COLA WAS INSIDE A BOX.

The research and equipment developed by Dr. Vourvopoulos and his research team are gaining international acclaim for the Institute and the University.

A device, called PELAN for Pulsed ELemental Analysis with Neutrons, was patented in November 1999. The United Nations wants to purchase one of the devices and develop it for detection of landmines, Dr. Vourvopoulos said.

About 25,000 people worldwide are injured each year by landmines, he said. "Several countries are terribly infested with mines," including Croatia, Bosnia, Afghanistan, Mozambique, Cambodia and South Africa, he continued.

The societal and humanitarian impact is present in all of the research conducted by Dr. Vourvopoulos and the Applied Physics Institute.

"By training I'm a nuclear physicist," Dr. Vourvopoulos said. He earned a diploma in physics from the University of Athens, Greece, and a master's and doctorate from Florida State University. His background includes research in Greece, at Oak Ridge National Laboratory in Tennessee and at Notre Dame, and professorships at Florida A&M and Vanderbilt. He came to Western in 1984 as head of the Department of Physics and Astronomy.

"Slowly I became more interested in applying my knowledge of nuclear research to societal problems," Dr. Vourvopoulos said.

In 1994, the Applied Physics Institute was established and continued work that had begun at Western in the late 1980s.

Support from federal agencies also has been vital. All research and salaries for faculty and students conducting research are funded by grants and contracts. Since 1994, agencies such as the Department of Energy, Department of Defense and the National Science Foundation have provided more than $3 million in grants and contracts.

The Institute's operations are housed at three sites: the main office at Nashville Road and Campbell Lane, an annex at the South Campus and at the WKU farm. Dr. Vourvopoulos is looking forward to the next few years when the Institute will move into a new facility that was funded by the 2000 Kentucky General Assembly.

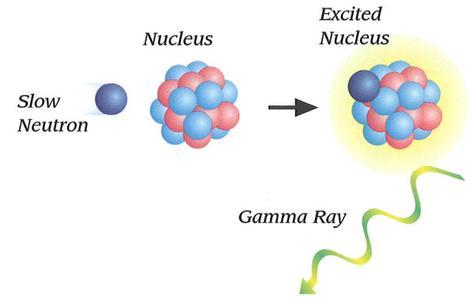
"Everyone in the University from the president to the dean has been extremely supportive of us," he said. "We couldn't have done it without their support."

Research can be a time-consuming, intense process. "It's a continuous evolution from the idea to the completed project," Dr. Vourvopoulos said.

Here is a simplified version of how the complex task is conducted:

1. Someone, the Western researchers or a federal agency, will present a problem.
2. Western researchers will develop the basic ideas of how to solve the problem.
3. They will then conduct a series of calculations and simulations.
4. Once researchers determine those calculations will provide satisfactory results, they design experiments.
5. After the first data are returned, the researchers create a laboratory prototype.
6. After more testing and research are completed, the lab prototype gives way to a field prototype for additional extensive testing, including statistical analysis and quality control.
7. The final testing is conducted by the agency that funded the project. For example, the Department of Defense tested the PELAN system.

Neutron Capture



Nuclear reactions initiated by thermal neutrons (capture reactions) and fast neutrons (inelastic scattering)

"You must use the best research you can do, but at the same time common sense must be included," he said. "There is no reason to create an instrument that is so complicated that it takes three Ph.D.s to operate it and then expect that it can used by members of a bomb squad."

While the instruments and devices built at the Applied Physics Institute are complicated and conduct complex tasks, "what you handle must be simple and must be packaged in a way that it can be used by people with minimal training," he said.

"We do all that here at Western using a lot of home-grown talent — students, faculty and technicians," Dr. Vourvopoulos said. The full-time research team of API is augmented with students and faculty from various departments, including physics, engineering, computer science, architectural and manufacturing sciences, and chemistry.

"The successful completion of a project is the greatest satisfaction we can have," he said.

Dr. Vourvopoulos' neutron-based online coal analyzer has reached the commercialization stage and may soon be installed in power plants. Work on the elemental coal analyzer began in 1987.

The $500,000 device measures the amounts of elements in coal to determine its sulfur content, moisture content, energy output and heating capacity. Coal-burning power plants can analyze the makeup of the coal before it is burned, thus making it easier to comply with federal clean air regulations.

Western's expertise and reputation into neutron-based research led to the projects for detection of explosives and drugs.

"What prodded us to go into this direction was a letter from a general in the U.S. Army who had read some work I had published and asked if we could help detect explosives," Dr. Vourvopoulos said.

That research has branched into three areas: detection of unexploded ordnance (shells in war-torn nations or U.S. proving grounds); detection of landmines; and detection of chemical warfare agents. Dr. Vourvopoulos, who was named 1998 Kentucky Scientist of the Year, is chairman of an international conference on explosives and drug detection techniques held in Crete, Greece.

His work on the detection of explosives has attracted the attention of the Office of National Drug Control Policy (commonly known as the White House drug czar), which provided Western with funding to develop a system to detect hidden drugs.

Western is working with U.S. Customs to develop a drug-detection system for major ports of entry.

The day-to-day research and reports, the collaboration with researchers at Western and worldwide, the conferences, the contract negotiations and the various other duties at the Applied Physics Institute keep Dr. Vourvopoulos busy. "I'm on the road a lot, probably 10 days a month," he said.

In mid-May, for example, his calendar included trips to Frankfort, Kentucky, Salt Lake City, Utah, and the Netherlands. He travels to Washington, D.C., about every three weeks and to Europe three to four times per year.

"On a weekly basis we have national and international contacts," he said.

That's where the next idea, project or grant may come from. And that's what keeps Dr. Vourvopoulos excited about his research and the future.

"I knew this is what I wanted to do. I wasn't sure I'd be able to do it here," Dr. Vourvopoulos said. "I think the pleasant part was that I was able to do it here."

Through his hard work and research, Vourvopoulos and the Applied Physics Institute are becoming household names worldwide. He has just licensed the PELAN Substance Detector to a large international organization.

Tommy Newton is a Communications Specialist in the WKU Division of Public Affairs.

Inelastic Scattering