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ANALYSE THIS

Now, a new laser-based device provides instant analysis of microparticles; gadget promises to change the face of medical diagnosis and terrorist detection

A new detector combines a laser with a mass spectrometer to provide on-the-spot analysis that researchers hope will have applications ranging from evaluating a tumour as it is removed, to quickly detecting explosives in luggage.

The laser vapourises tiny samples that can be instantly analysed by the spectrometer, and can be used even on living organisms, the US team said on Thursday.

"We are talking about less than a second for an analysis," said Akos Vertes, a professor of biochemistry and molecular biology at George Washington University.

Vertes and graduate student Peter Nemes say they have used their system to find a drug sample in urine, to detect the chemical changes that accompany colour changes in a living plant leaf and to find explosives residue on a currency note.

The university has filed for a patent on the system, which Vertes said is the first to use a laser for such instant analysis of living tissue.

Called laser ablation electrospray ionisation, or LAESI, it requires a desk-sized space in a laboratory. But smaller spectrometers and lasers could make it portable, Vertes said.

The laser burns the living tissue, vapourising some of it and sending particles up into the air in a puff. In a process called electrospray ionisation, a stream of electrically charged droplets is shot at the spot, intercepting the particles and merging with some of them to make charged droplets.

The mass spectrometer then measures the charged particle, called an ion.

Vertes and Nemes say the ionising drops can be shot from a tiny nozzle that can be bundled with a fibre-optical cable carrying the laser beam, and a small tube to carry the sample into the spectrometer to be analysed.

REUTERS

Akos Vertes (L), professor of chemistry, biochemistry, and molecular biology, and graduate student Peter Nemes show their detector, which combines a laser with a mass spectrometer to provide on-the-spot analysis that researchers hope will have applications ranging from evaluating a tumour as it is removed to quickly detecting explosives in luggage

"You can just go into the field and put your laser on the surface you want to analyse," Vertes said.

By taking a series of samples, the detector can analyse cell-by-cell changes.

This could help biologists understand a living system, and could help surgeons as well – for example, by analysing tumours as they are removed.

"You are already cutting the patient, so a little bit of a prick with a laser is not much more," Vertes said. "It is very important to know when the cancerous tissue ends and the healthy tissue begins."

Currently, surgeons send samples to a pathology lab; but this system could save precious minutes, he said.

Vertes is also trying to use it to see stem cells in the process of differentiating, or changing, into the various cell types that they can give rise to. Current methods require scientists to look for one change at a time in each cell sample – destroying the living cells in the process. REUTERS

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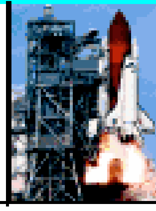

DID YOU KNOW?
Space Shuttle Atlantis is one of the three currently operational spacecraft in NASA's fleet, the other two being Discovery and Endeavour. Atlantis has completed 28 flights, spent over 220 days in space, completed 3,468 orbits, and flown a whopping 1,66,510,972 km in total, as of September 2006. It also holds the distinction of conducting back-to-back missions with the shortest interval of 50 days in between

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'Green' sea-robot that propels itself

WASHINGTON: A seagoing glider that uses heat energy from the ocean to propel itself is the first "green" robot to explore the undersea environment, US researchers said on Thursday.

The robot, dubbed the thermal glider, has crisscrossed the 13,000-feet-deep Virgin Islands Basin in the US more than 20 times since it was launched in December. And it could keep going on its own for another six months, the team at the Woods Hole Oceanographic Institution and Webb Research Corporation predicted.

"Gliders can be put to work on tasks that humans wouldn't want to do or cannot do because of time and cost concerns," said Dave Fratantoni of Woods Hole. "They can work around the clock in all weather conditions."

WOODS HOLE OCEANOGRAPHIC INSTITUTION

The thermal glider in action

Such robots can carry sensors to measure temperature, salinity and biological productivity. They usually surface from time to time to fix their positions using GPS and to communicate via satellite to a laboratory.

Most gliders rely on battery-powered motors and mechanical pumps, the researchers said.

The thermal glider, however, draws its energy from the differences in temperature between warm surface waters and the colder, deeper layers of the ocean.

The heat content of the ocean warms wax-filled tubes inside the engine. The expansion of the warming wax converts heat to mechanical energy, which is stored and used to push oil from a bladder inside the vehicle's hull to one outside, changing its buoyancy. Cooling of the wax at depth completes the cycle.

"We are tapping a virtually unlimited energy source for propulsion," Fratantoni said.

He said data collected by the glider would help researchers understand how eddies in the region affect ocean circulation and move around the larvae of fish as well as pollutants. REUTERS

ATLANTIS TAKES OFF

REUTERS

After two months of delay, NASA's Atlantis roared off the launch pad at Cape Canaveral, Florida at 19.45 GMT, Thursday (01:15 IST, Friday), carrying Europe's gift to the International Space Station (ISS) – a $2-billion science lab named Columbus. Atlantis' commander Stephen Frick and his 7-man crew of US, German and French astronauts will reach the space station today and will begin installing Columbus on Sunday. Three spacewalks are planned during the mission, scheduled to last 11 days. "Columbus means so much to Europe," said Alan Thirkettle, ESA's space station program manager. "We finally will have our own real estate in orbit."

Making electricity from your knee

WASHINGTON: Call it the ultimate power-walk. Scientists in the US and Canada said on Thursday they have developed a unique device to be strapped on the knee that exploits the mechanics of human walking to generate a usable supply of electricity.

With each stride the leg accelerates and then decelerates, using energy both for moving and braking. And it generates enough power to charge up 10 cell phones at once, the researchers report in the journal *Science*.

The first practical use for the generator is likely to be in producing power for artificial limbs, said researcher Max Donelan of the Canada-based Simon Fraser University.

Other potential uses include powering a portable GPS locator, a motorised prosthetic joint or implanted drug pumps. It could be of value to hikers or soldiers who may not have access to electricity, they said.

Many researchers have been working on ways to harness the motion of the human body to create power.

Previous inventions including a shoe-mounted device were nice and light, but did not generate much electricity. Similarly, a backpack device that generated power as it bounced up and down while a person walks generated a lot of electricity, but was heavy to lug.

The new energy-capturing knee brace, its inventors said, seems to find a happy medium – generating decent amounts of power while still being relatively light.

Arthur Kuo, a mechanical engineer who worked on the device at the University of Michigan in the US, said it works similarly to the way that regenerative braking charges a battery in hybrid cars.

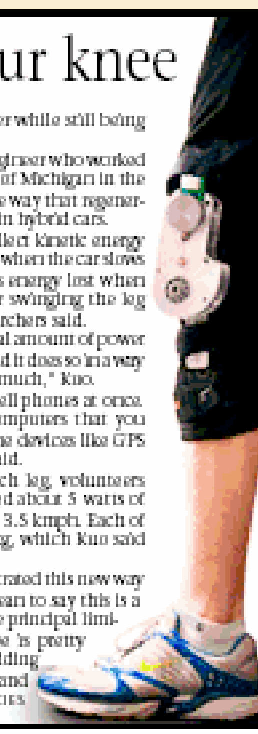
These regenerative brakes collect kinetic energy that normally dissipates as heat when the car slows down. The knee device collects energy lost when a person brakes the knee after swinging the leg forward to take a step, the researchers said.

"It generates a fairly substantial amount of power compared to previous devices, and it does so in a way that doesn't affect the user very much," Kuo.

"You could easily power 10 cell phones at once. There are some low power computers that you could power. You could imagine devices like GPS locaters, satellite phones," he said.

With a device placed on each leg, volunteers walking on treadmills generated about 5 watts of electricity walking at a leisurely 3.5 kmph. Each of the devices weighs about 1.6 kg, which Kuo said was still too unwieldy.

"Even though we've demonstrated this new way to generate power, we don't mean to say this is a usable product at this time. The principal limitations are that our prototype is pretty heavy and bulky," Kuo said, adding that it can be made smaller and more practical. AGENCIES



The 1.6kg device, strapped to the knee (pictured), harnesses the body's movements to generate enough electricity to charge 10 cell phones at once