High-speed discovery helps measure greenhouse gases from space

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(Phys.org) —Scientists have discovered how to measure greenhouse gases 200,000 times faster as the result research by an award-winning PhD student from The University of Western Australia and a US team.

The discovery - which is already being used by NASA scientists in Space - has major implications for global warming research, breath analysis (to detect illness), explosives detection, chemical process monitoring and a range of other applications, including fundamental quantum theory.

UWA physics graduate Gar-Wing Truong used highly-sensitive rapid laser scanning technology to help lead US scientists from National Institute of Standards and Technology (NIST) in Maryland to build new gas measurement equipment with unparalleled speed, accuracy, precision and spectral coverage.

NASA's Jet Propulsion Laboratory in California has begun using data from Mr Truong's research to calibrate carbon monitoring satellites in orbit around Earth and better understand carbon dioxide molecules.

The research is an extension of Mr Truong's PhD project on precision spectroscopy for gas metrology, which he has conducted at the University since 2009 under the supervision of UWA Winthrop Professor Eric May and former Winthrop Professor Andre Luiten (now at University of Adelaide) , with funding from the Australian Research Council's Discovery program.

Mr Truong said better, more reliable data on global warming held significant benefit to society, helping researchers better understand its causes and accurately evaluate the impact of policy decisions.

"This research is of particular significance to Australia if it is to take the lead in global warming policy and research," Mr Truong said. "It is also highly relevant to WA, where the economy is strongly driven by oil, gas and mineral industries."

Mr Truong, who worked on the new spectroscopy technique while on a year-long Australian Fulbright Fellowship at NIST, said the breakthrough combined ideas already being developed at UWA with apparatus and methods used at NIST.

The resulting novel approach - dubbed Frequency-Agile, Rapid Scanning spectroscopy, or FARS - had greatly improved the speed at which gases could be traced without compromising on precision.

"Usually in science or engineering if you want to make measurements go faster, you have to sacrifice sensitivity," Mr Truong said. "What we have demonstrated here is a 200,000-fold increase in speed to enable high-precision spectroscopy without degrading sensitivity - we've built a new apparatus with unparalleled speed, accuracy, precision and spectral coverage."

"The unique properties of FARS make it well suited for many existing challenges in trace gas sensing," Mr Truong wrote in a paper published online today in the journal, *Nature Photonics*. "We see clear applications in the real-time measurements of greenhouse gas fluxes, as well as in the monitoring of dynamic processes such as combustion."

More information: dx.doi.org/10.1038/NPHOTON.2013.98

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