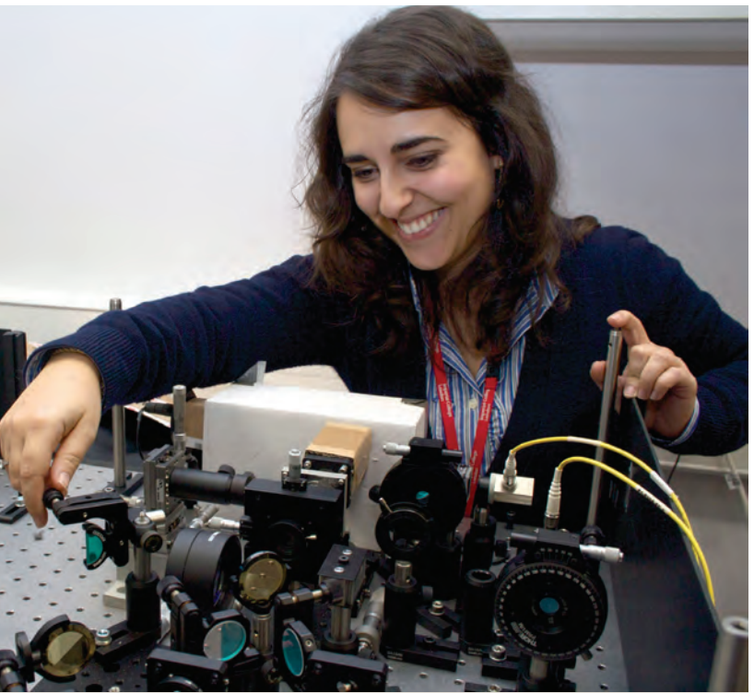


Light reading

The Department of Physics' nanoplasmonics group

Stefan Maier's nanoplasmonics group started five years ago with just one other member. It is now a 30-strong team which last year produced 40 publications, almost all in high impact journals, including *Nature* journals and *Science*. *Reporter* met with Stefan and the group.

Some scientists work mostly with chemicals, others with cells, and some with metals. For Professor Stefan Maier (Physics) and his team their currency is light. They try to understand it at a fundamental level, capture it, channel it at the tiniest scale and use it to perform an array of useful technological functions.

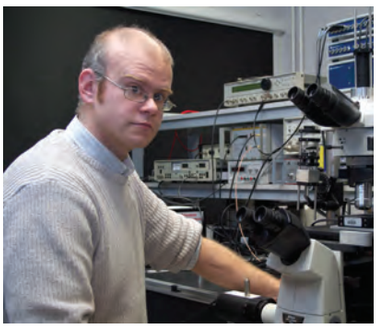
Working in experimental physics is challenging to say the least. But the Maier group balances that with bouts of squash and generous helpings of tiramisu – leaving them refreshed and ready for the real work.

"Plasmonics is the study of how light interacts with metallic nanostructures", explains Dr Yannick Sonnefraud, the first and longest-serving member of Maier's group and now a research fellow.

"Light waves couple with the oscillating waves of electrons inside the metal," adds research fellow Dr Antonio Fernandez-Dominguez. "They interact to form a new entity that has the properties of the two – light waves and electron waves. It is this entity that we call a plasmon."

This is, in some ways, similar to what happens in a radio antenna. Radio waves create a current in the metal aerial, which is integrated with the electronics and converted into the sound we hear.

But scientists would really like to make an antenna to convert visible light into a plasmon. This could lead to a range of diverse applications such as extremely fast information processing devices for the telecommunications industry; high-density data storage; and super sensitive chemical detectors that could spot just a couple of molecules of explosive in a liquid sample.



Left to right: PhD student Giuliana Di Martino and Research Fellow Dr Yannick Sonnefraud, both the nanoplasmonics group.

Dr Tyler Roschuk, who has been a post-doc in the group for three years, looks at ways to integrate photonic components such as fibre optics and laser diodes with much smaller microelectronic features.

"We could focus the light down with a nanoplasmonic antenna. Then instead of metal wires between electronic components, we would have plasmonic wires. This would lead to faster devices because multiple packets of information could be sent down the same wire at the same time, much like how several hundred telephone calls can be sent down the same fibre optic cable," he says.

> "Key to the success of our group is that we have been able to collaborate so widely"

Meanwhile postdoc Dr Heykel Aouani is trying to make nanoantennas that can handle a much broader range of wavelengths, which could lead to powerful sensors for biological applications and security.

"A liquid sample of interest would be wiped over a chip and light would be reflected off this and examined. The use of nanoantennas would indicate whether certain chemicals, such as TNT, are present in the sample. This technology could therefore be useful in airport security scanning in the future," he says.

Some of the PhD students enjoy the benefits of working across two different groups such as Krystallo Hadjicosti, who is co-supervised by Stefan and Dr Katya Shamonina (Electrical and Electronic Engineering).

"Working in this area requires knowledge and experience in both electronics and physics. Collaboration is essential to establish the theory and apply it. Besides, networking in science is very important and being able to meet people from both fields triggers new ideas," she says.

Her situation is not unique, however, and is indicative of the Maier group's philosophy on collaboration.

"Key to the success of our group is that we have been able to collaborate so widely," says Stefan who points to work they've done with Professors Sir John Pendry, Ortwin Hess, Lesley Cohen, and Drs Ned Ekins-Daukes and Paul Stavrinou in Physics, Professor Neil Alford in Materials and Katya in Electrical and Electronic Engineering, in addition to international collaborators.

But the group's success also owes a lot to its friendly environment. "We have a squash ladder tournament whilst Friday beers are also an important event in the group," says research fellow Dr Vincenzo Giannini. "Our members come from all over the world and we try to mix our knowledge."

"We sometimes compete to see who can make the best version of each other's national meals," adds PhD student Giuliana Di Martino. "Yannick made a very good tiramisu recently. But there's a few of us Italians in the group and we weren't going to go as far as admitting that a Frenchman knows how to make a better tiramisu than an Italian!"

As the group moves forward into 2013 there are plenty of exciting challenges to come. Two post docs in the group have recently been awarded Junior Research Fellowships and two alumni have gone on to professorships at overseas universities. It's probably fair to say that in the years to come, the group as a whole will continue to drive advances in the field of nanoplasmonics, which will have an increasing impact on business and consumer technology worldwide.

—SAM TRACEY FOR COMMUNICATIONS AND DEVELOPMENT