

Outreach project amongst top 1%

A group of secondary school students supervised by ORC research lecturer, Dr. Eric Plum, have won a prestigious student research competition, becoming state champions in Physics in recognition of their research on optical computing.

The students' project is part of a longstanding international collaboration between St. Michael-Gymnasium secondary school in Bad Münstereifel, Germany, and Southampton's ORC, which featured in Nature Nanotechnology last year. The collaboration benefits many groups of students that participate annually in Europe's biggest science competition, "Jugend forscht" (youth researches).

Under the initiative, students conduct their own independent research projects – much like postgraduate research projects. In 2016, 12,000 students are competing in 7 subject areas and 2 age groups. The work of the A-level students Adrian Lenkeit, Marvin Lohaus and Max Oehmichen from St. Michael-Gymnasium has already attracted a lot of attention at the regional competition in Düsseldorf, winning awards sponsored by the chamber of industry and commerce and the University of Düsseldorf in addition to the first prize in Physics in February.

By winning in Germany's most populous state, North Rhine-Westphalia, as well as receiving the Minister for Schools' award for the most creative project on March 16th, the students are amongst the top 1% of participants. Their work has now qualified for the national competition, which will take place from May 26th until May 29th in Paderborn, Germany.

Adrian, Marvin and Max conducted successful proof-of-principle demonstrations of elementary logical operations for all-optical computing using microwaves and metamaterials. Their work is based on the realisation that the interaction of a thin functional material, a metasurface, with an electromagnetic wave can be controlled by a second electromagnetic wave. When both waves interfere constructively on the metasurface, its effect on the waves is amplified, while destructive interference renders the metasurface transparent. On this basis, the students have demonstrated various all-optical logical gates, the elementary building blocks of an optical computer.

ORC lecturer Eric Plum, who supervises the work in collaboration with teachers Veronika and Walter Stein, comments: "The project is inspired by research going on at the ORC. It brings aspects of our recent breakthroughs – in a simplified form – into the classroom and exposes it to the general public. At the same time, creative students also try new things that may feed back into our research."

The three day state competition was open to the public and attracted large numbers of students, teachers and parents, as well as lots of press coverage, while the national competition in May will attract an even bigger audience.

Find out more about the [metamaterials research](#) in Southampton.

Find out more about student research projects at [St. Michael-Gymnasium](#)

[Nature Nanotechnology article](#) about the outreach collaboration.



The winning team: Marvin Lohaus, Max Oehmichen and Adrian Lenkeit with their experimental setup at the state competition hosted by Bayer AG in Leverkusen, Germany (Image source: Bayer AG).