ETH zürich
NO. 1/2016

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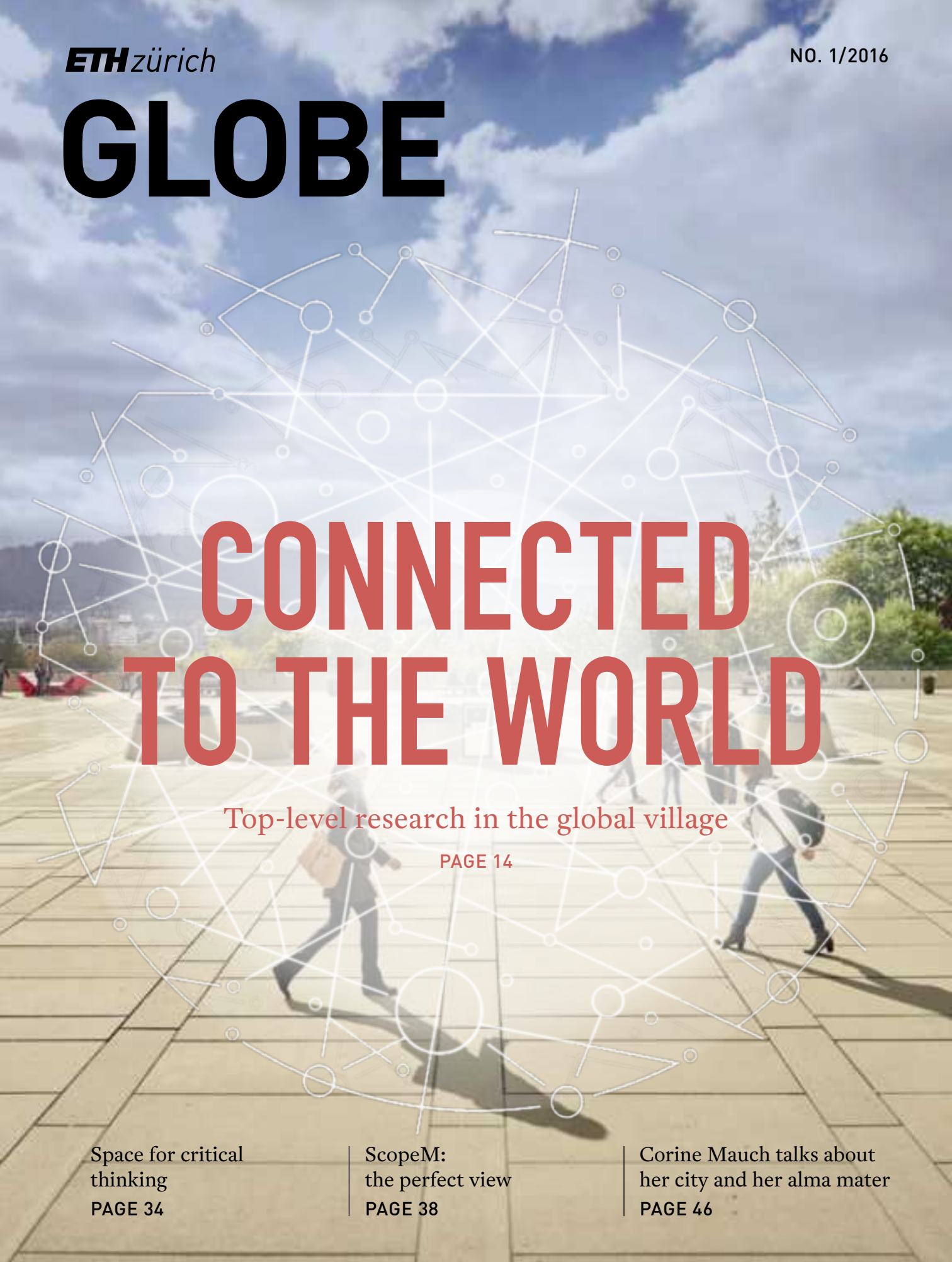

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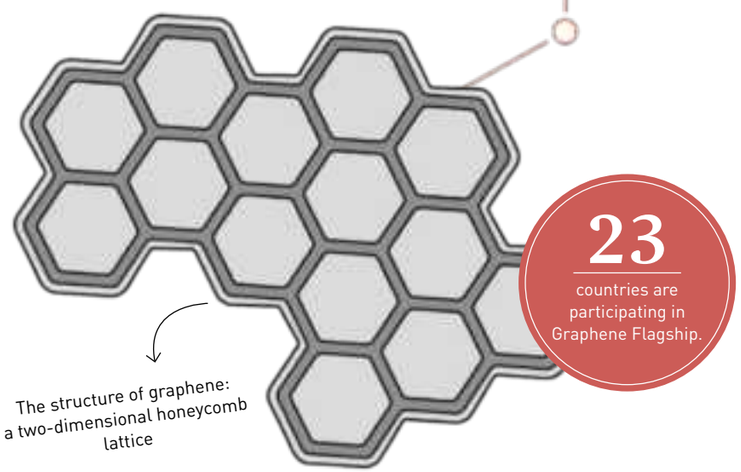
A DECISIVE STATEMENT

A bright future is in store for graphene because of its remarkable properties. It's therefore a logical step for the EU to devote one of its two Flagship projects to exploring this material. ETH physicist Klaus Ensslin is on the project team.

TEXT Felix Würsten

It was a good ten years ago that Andre Geim and Konstantin Novoselov, two physicists at the University of Manchester, caused an uproar with a new material. Their development, graphene, consists of just a single layer of regularly arranged carbon atoms and possesses qualities that characterise it as a genuine wonder material. Graphene is virtually transparent and conducts electricity; it is elastic and yet stable; it is dense enough that no atom can pass through it; and it can also be economically produced in near-perfect quality.

With characteristics like these, it is no surprise that many are hoping for great things from graphene. And since Asia is already working feverishly to develop possible applications, Europe doesn't want to be left behind. Two and half years ago, the EU awarded one of its two prestigious Flagship projects to a consortium for researching this material more intensively and on a broader level. Research groups from across Europe have since then been working on developing applications for graphene in 16 fields.



The structure of graphene: a two-dimensional honeycomb lattice

23
countries are participating in Graphene Flagship.

Stubborn edges

One of the people on the project is Klaus Ensslin, ETH professor at the Laboratory for Solid State Physics. Together with research colleagues in Manchester, Geneva, Regensburg and Madrid, he is investigating whether it would be possible to use graphene in the manufacture of quantum structures, which could then be employed in building quantum computers. The researchers aim to produce the tiniest of structures within which they can control the spin of the electrons.

Graphene appears to be an ideal material for this process, since the nuclei of carbon atoms affect electron spin less strongly than those of other elements. In any event, graphene has proven to be a surprisingly stubborn candidate. The edges of the 20 to 50 nanometre quantum structures affect the behaviour of the electrons more intensely than expected. For this reason, the researchers want to take a closer look at the structure of the edges.

THE PROJECT

"Graphene" and the "Human Brain Project" are the two Flagship projects launched by the EU in 2013. The Graphene project is designed to run for ten years and has a total budget of about one billion euros. Under the leadership of Chalmers Technical University in Sweden, 142 research groups are participating in the project.

Transparent, conductive, flexible, robust: Industry is pouring all its hopes into graphene.

Basic research of the sort Ensslin conducts is actually quite important for graphene research. Yet the Flagship project is clearly oriented toward application, given that the overriding goal is to inject new life into European industry. This is also why so many industrial groups are participating in the Graphene project. "Korea has launched a national graphene programme, and China has big plans in this area as well – it makes perfect sense for Europe to nail its colours to the mast, too, and consolidate its position," Ensslin says. Indeed, graphene could conceivably be incorporated into a broad range of products: aircraft support structures, water filters, tires, sensors, touchscreens, batteries, even condoms – the possibilities are many and varied.

Clear potential for application

Ensslin is the sole ETH researcher participating in this EU showcase, a situation that is due to an administrative rule. He was already involved in the undertaking during the initial phase; when the Graphene Flagship project was approved, those institutions that had already participated in the first phase were not allowed to send any other researchers. This rule prevents all other ETH professors working with graphene from working on the project.

Ensslin was always certain that Graphene would receive the go-ahead: "There are four Nobel laureates actively participating in our project; that alone shows how relevant the endeavour is in a scientific sense. And the potential for application is plain to see." Although the administrative effort for this kind of project is enormous, Ensslin's impression is positive overall – "The collaboration functions well." This is in no small part due to pragmatic management: the director of the Flagship project has highly developed diplomatic skills. Whether or not the funds invested overall are being allocated truly efficiently can always be discussed. "At the end of the day," Ensslin says, "the decision on what type of big projects to finance is a political one. With Graphene, the EU is sending a strong message: Europe will not relinquish its leading role in this area." ○

KLAUS ENSSLIN

Klaus Ensslin has been a professor of experimental physics at ETH Zurich since 1995. His research focuses on the electronic properties of new types of semiconductor components. One of his primary objectives is to control the quantum properties of electrons in nanostructures.

Graphene Flagship Project:
→ http://graphene-flagship.eu

Photos: Dreamstime; Giulia Marthaler