Speech by

Professor Daniel Loss

Co-Winner of the 2017 King Faisal International Prize for Science
39th KFIP Awards Ceremony
Tuesday 04/04/2017

It is a great honor for me to receive the King Faisal International Prize for Science 2017 in the field of Physics. I am particularly pleased to share this prestigious Prize with Laurens Molenkamp, a pioneer of spintronics and topological insulators.

First, I would like to thank my collaborators who have worked with me over the years and made many important contributions to the science that led to this award. I also express my sincere thanks to my colleagues and friends at my home institutions for continued support and fruitful collaboration, and last but not least to my family who gave me all the support and freedom that I needed for my research.

A topic which has fascinated me during my whole career is the physics of spins in condensed matter systems, especially in the quantum regime where coherence and entanglement of quantum states are crucial. I started to work on spin effects in mesoscopic systems in the early nineties in Urbana, USA, where I was fortunate enough to work under Nobel Laureate Tony Leggett who had a profound influence on me. From there on, the topic of spin was essentially always present in my research, especially so in the then-nascent field of spintronics where not only charge but also spin degrees of freedom in semiconductors became relevant, leading us to uncover many novel effects and to develop a new field, together also with Laurens Molenkamp.

Around the same time, in the mid-nineties, the concept of quantum computers came up and the question of how to realize such an exotic machine captivated many researchers' imagination, including mine. Is it possible in principle? And is spintronics the way to go? An early hint for me came from experiments showing that the

lifetime of spin states can be surprisingly long in semiconductors. This led me and David DiVincenzo to propose the concept of spin qubits in quantum dots, based on an all-electrical scheme that is fast and scalable. While the idea was quickly embraced by others around the globe, the physics of our scheme turned out to be extremely rich and challenging, giving birth to a new field which pursues the goal of building a quantum computer with spin qubits. Reaching this goal will be a culmination of modern quantum science, which is not only interesting from a fundamental point of view but also likely to revolutionize our information society. I feel very fortunate to have been able to contribute to these developments, working with many outstanding colleagues who shared my passion for physics.

I would like to conclude by expressing my deepest gratitude to our hosts for their hospitality and for making this week such a special and memorable event.

Kind regards

Daniel Loss