

Electrons seem heavier in extremely thin silicon

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For years now, transistors have been getting smaller and smaller. Research conducted by Jan-Laurens van der Steen of the MESA+ Institute for Nanotechnology at University of Twente, The Netherlands, has shown that electrons in silicon which is less than ten nanometres thick take on unusual characteristics.

To gain a better understanding of these nano-scale characteristics, he has worked on an accurate model which will play a very important role in the micro-electronics industry. He will defend his thesis on April 1st 2011 at the Faculty of [Electrical Engineering](#), Mathematics and Computer Science.

Moore's Law states that the number of [transistors](#) inside a chip will double every eighteen months. In order for this to happen, transistors need to become ever smaller. Jan-Laurens van der Steen's research at the University of Twente has been looking at what happens when [silicon crystals](#) thinner than ten nanometres are made, a scale which the industry will soon reach.

Van der Steen's research revealed that the characteristics of the material begin to change drastically, a phenomenon that is often encountered in [nanotechnology](#). In silicon of this thickness, it turns out to be more difficult to move the free [electrons](#) around. It seems as if the electrons become heavier compared to thick silicon samples. The research also showed that the mean free path of the electrons - the distance which they can move before they bump into something - gets shorter in thin silicon

films.

In order to make use of these characteristics, it is important to be able to predict how nano-scale transistors will conduct electricity. Van der Steen has therefore developed a model which can explain these properties on both large and small scale structures. The model is known as a Single Scattering Model and is important for the development of the 11-nanometre CMOS generation and the even smaller generations to come.

More information: Van der Steen's thesis is entitled *Geometrical Scaling Effects on Carrier Transport in Ultrathin-Body MOSFETs*.

Provided by University of Twente

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