Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Energy filtering in nanowires MAARTEN THEWISSEN, BART SORÉE, WIM MAGNUS, Univ of Antwerp, IMEC COLLABORATION — Nanowires present a viable geometry to allow for future semiconductor device scaling. When the dimensions of these nanowires become comparable to the wavelength of the carriers, quantum effects may have a profound impact on the transport properties of the wire. An example of such effect, theoretically investigated here, is the introduction of a periodic potential profile along the transport direction. This could be achieved by repeatedly varying the diameter of the wire, by including a superlattice perpendicular to the wire, by applying a periodic electric field etc. The consequent resonances will effectively block electrons at some energies, while allowing others to pass, and hence function as an energy filter. Such property might be beneficial for its use in a transistor. The transmission of electrons through the wire is examined here, by solving Schrödinger's equation in the effective mass approximation and Poisson's equation self-consistently. As for the contacts, quantum transmitting boundary conditions are used as suggested by Lent. The result shows that energy filtering as described can indeed occur in realistic device structures.

Maarten Thewissen
Univ of Antwerp

Date submitted: 13 Nov 2014 Electronic form version 1.4