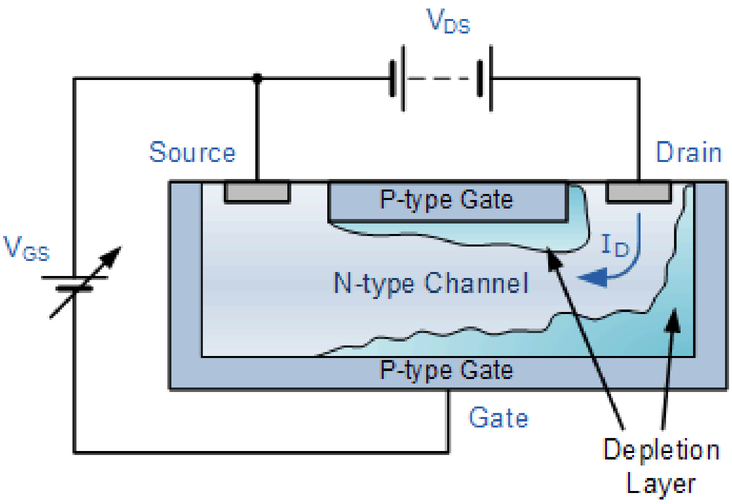
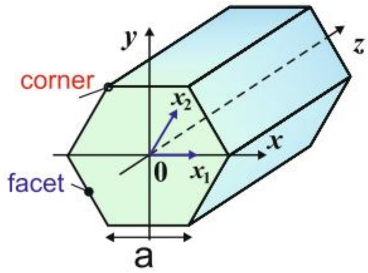
Research (What is it about?)	**Electron gas in semiconductor nanowire**
UNN authors	*Degtyarev V., Khazanova S.*
We find (The result)	2D distribution of electron gas density in hexagonal *InAs* nanowire is found
Abstract	Semiconductor devices are mostly layered (1D) structures in which the deflection of flat structures is slow at the scale of de Broglie electron and holes wavelengths. So it operation are determined by 1D profile of carrier distribution. Introduction of the second (even slow) dimension in electron gas distribution at one time (channel region in field effect transistors) allowed one to raise substantially the speed of electron devices. Semiconductor 2D structures with transverse size as de Broglie wavelength (nanowires) represent new facilities for electronics. The transverse space distribution of electrically charged quantum objects in these structures will be obviously heterogeneous. The mechanics of its distribution will be described by two-dimensional Schroedinger equation for the envelop function while forces will be determined by Poisson equation for fields and charges with the boundary conditions which depend on transverse section of nanowire. We present a study of electron gas properties in *InAs* nanowires determined by interaction between nanowire geometry, doping and surface states. The ***electron gas density*** and space distribution are calculated via self-consistent solution of coupled Schroedinger and Poisson equations in the ***nanowires with a hexagonal cross-section***. We show that the density of surface states and the nanowire width define the spatial distribution of the electrons. Three configurations can be distinguished, namely the electrons are localized in the center of the wire, or they are arranged in a uniform tubular distribution, or finally in a tubular distribution with additional electron accumulation at the corners of the nanowire. The latter one is dominating for most experimentally obtained nanowires. ***N-type doping partly suppresses electron accumulation at the nanowire corners***. The electron density calculated for various nanowire widths and different positions of the Fermi level at the nanowire surface, is compared with the experimental data for intrinsic *InAs* nanowires. Suitable agreement is obtained by assuming a Fermi level pinning at 60 to 100 meV above the conduction band edge, leading to a tubular electron distribution with accumulation along the corners of the nanowire.

Representative articles 2017-2018, quartiles	1. *Degtyarev V.E., Khazanova S.V., Demarina N.V.* Features of electron gas in InAs nanowires imposed by interplay between nanowire geometry, doping and surface states. Sci. Reports. **7**: 3411 (2017).	Q1
	Q-index (Qi) for the result	**4**
	high blue	

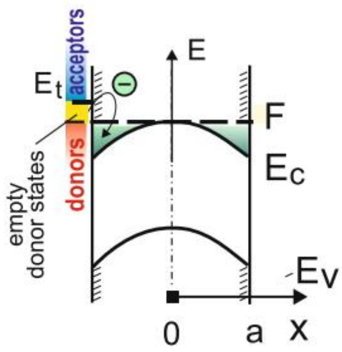
In collaboration	Peter Grünberg Institute-2, Jülich D-52425, Germany Jülich Aachen Research Alliance-Fundamentals of Future Information Technology, Jülich, Germany



Pseudo-2D semiconductor structure (field effect transistor), which allowed one to raise substantially the speed of electron devices.

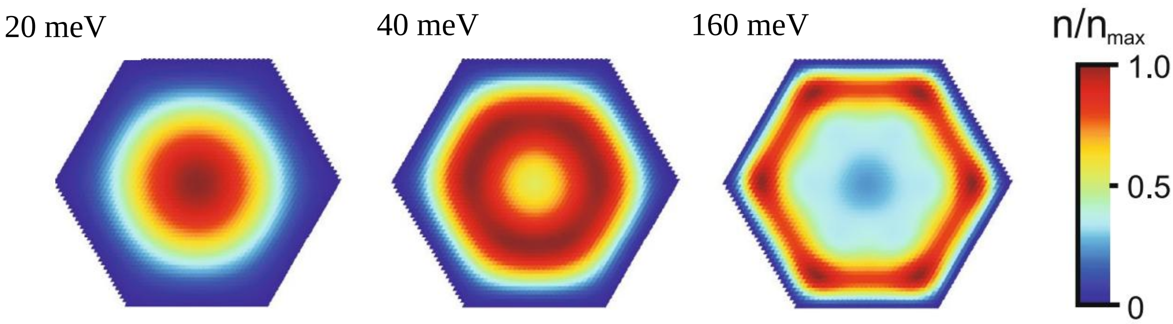


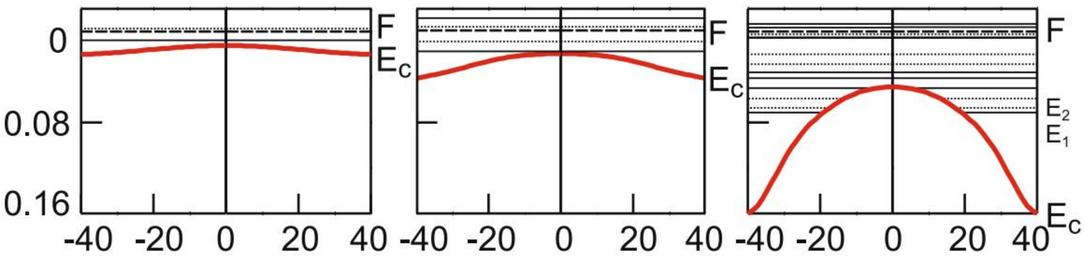
Sketch of a nanowire.



Schematic band diagram of *InAs* nanowire with the donor- and acceptor-type surface states and electron accumulation region at the nanowire surface where E_c and E_V denote the conduction and valence band edge, correspondingly, and F is the Fermi level.

2D electron distribution in a nanowire with a side length of 40 nm for different positions of the Fermi level above the conduction band edge at the surface (T = 4 K).





The conduction band diagram and the energy states (non-degenerate (solid line) and doubly degenerate (dashed line)) in the nanowire for the values of $(F - E_c)$ indicated above.