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# Electric field domains and self-sustained current oscillations in weakly-coupled long period GaAs/AlGaAs superlattices

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The self-sustained current oscillations associated with electric field domains in long period GaAs/AlGaAs superlatices were investigated experimentally as well as by numerical simulation. The MBE-grown GaAs/AlGaAs superlatices ($d_W$ = 250 Å, $d_B$ = 100 Å, 30 periods) were lightly doped and embedded within $n^+$-contacts. Several (4) plateaus with pronounced oscillatory-like negative differential conductivity (NDC) structure corresponding to formation of electric field domains were observed in time-averaged I–V characteristics.

The current oscillations were observed at constant bias voltage corresponding to plateau-like regions of I–V characteristics. The fundamental oscillation frequency (between 20 kHz and 10 Mhz) increased with increasing index of subband involved in the tunneling resonance. The transition from periodic to chaotic oscillation regime was observed when bias voltage came into ranges of negative differential conductivity in I–V characteristics of the superlattice.

The periodic and strong dependence of the oscillation frequency upon the bias voltage was observed within plateau, the oscillation frequency continuously tuning within each period. The observed periodic dependence is correlating with the periodicity of NDC structure in time-averaged I–V characteristics.

The interpretation of the experiment is based on the numerical simulations within the discrete drift model of resonant tunneling and electric field domain dynamics in superlattices [1]. For the drift velocity curves used in the calculations and determined from comparison with experimental data the simulation showed that in considered case the oscillation mechanism is the oscillating of the position of the domain boundary being pinned within a few periods of the superlattice.

It is also shown that introducing into the superlattice of a single quantum well with lower dopant concentration may stimulate the self-sustained current oscillations due to domain instability in the vicinity of such a defect [2].

## References

[1] Yu. A. Mityagin and V. N. Murzin, *JETP Lett.* **64**, 155 (1996).
[2] Yu. A. Mityagin, D. G. Batashov and V. N. Murzin *Physics of Low-Dimensional Structures* **1/2**, 117 (1998).