INSTITUT ZA FIZIKU

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

SOFT @ IphyZ
http://soft.ifs.hr

LABORATORY OF NANOSCALE BIOLOGY LBEN
http://lben.epfl.ch

Open Position (PhD) in Physics of nano/bio hybrid devices

We are seeking highly committed candidates for a **PhD position** (2 years, possible extensions for 1-2 years). Work will be performed in the framework of the UKF project **"CONFINED DNA"** in collaboration of T. Vuletić (Institut za fiziku, Zagreb) and prof. A. Rađenović (LBEN, EPFL, Switzerland). The central aim of this project is to design novel structures/devices based on graphene in combination and in interaction with DNA.

Your Profile:

- Distinct skills in communication (oral and written), teamwork and working/learning in a highly interdisciplinary area, scientific commitment and creativity
- Distinct skills in experimental laboratory work (more than 6 months), demonstrated during Master's Thesis preparation
- Master's degree in p*hysics* (preferential, not essential: training in experimental surface science and/or biophysical techniques – a general background in condensed matter)

Other Essentials:

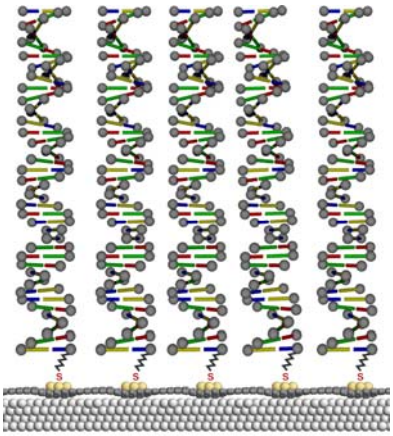
- Contract date: 01. 12. 2013. - 01. 12. 2015. (workplace IphyZ, Zagreb)
- Gross salary: ~5600 kuna/month (regular Croatian "scientific novice" salary) . Additional funding for expenses during working visits to LBEN in Switzerland (2400€/month, 6 months in total)
- Enrollment in Doctoral/Graduate School in Lausanne
- After 01.12.2015., for a satisfactory candidate, the position could transfer to Lausanne, towards completion of a PhD thesis (1-2 years +)
- Your application includes: letter of motivation, CV, certificates, publication list (if available), contact information of previous supervisor(s), letter of recommendation (if available)
- Application deadline: 01. 11. 2013
- Interwiews (by T. Vuletic and A. Rađenović): 05.10.2013. in Zagreb and 06.-08.10.2013. in Primošten, the venue of the 8th Croatian Physical Society Conference.

Submit your application and queries to dr.sc. Tomislav Vuletić (tvuletic@ifs.hr) for further information.

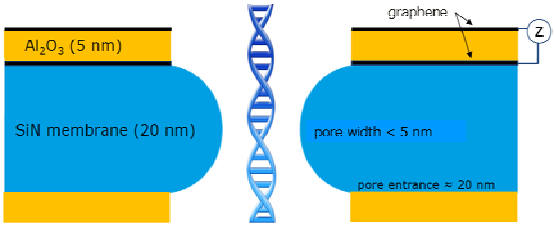
dr. Tomislav Vuletić

Prof. Aleksandra Radenović

CONFINED DNA



Epitaxial graphene (dark spheres) on Iridium (light gray) exhibits a long-range corrugation with the periodicity of 2.5 nm, comparable to DNA diameter. Thiolated DNA could bind specifically to Au-clusters (yellow).



Two graphene layers (black) with alumina layer (orange) as the insulator form a capacitor supported by the silicon-nitride membrane (blue).

The exploration of living cell is the major technological challenge for the 21st century. From a physicists perspective, DNA and proteins are nano-machines that function in the crowded environment of the cell. For technological applications we have to extricate different cell components and confine them to a solid state device – to form a hybrid system. Currently, the most promising concepts for low cost, high-throughput DNA sequence mapping and/or sequencing are based on DNA arrays (confinement in two dimensions) and on nanopores - DNA translocating through nanometer-sized pores (confinement in one dimension). Confined DNA hybrid systems should be capable of label-free electronical readout of the sequence, without costly labeling and enzymatic reactions. The ability to sequence DNA quickly and at low cost is essential to e.g. the studies of antiobiotic resistance, evolutionary studies and enables the personalized medicine concept.

The immediate objective of our project is to combine the expertise available at the Institute of physics, Zagreb (IphyZ) in the fields of surface and DNA physics. Our goal is to open confined DNA hybrid systems studies in Croatia, in partnership with the Laboratory of Nanoscale Biology from École polytechnique fédérale de Lausanne (EPFL).

Understanding the charge of DNA, surrounding ions, and potentials within the constraints of an array or a nanopore are a fundamental requisite. We intend to create and test two original hybrid systems.

One is the DNA anchored on the lattice of gold clusters templated by the corrugated graphene. Corrugation of the graphene has the periodicity 2.5-3 nm, comparable to the double-stranded DNA diameter. Such a template may lead to formation of a highly ordered and dense DNA array in presence of multivalent salts.

The other system is DNA translocating through a pore (diameter below 10 nm) created in a graphene-insulator-graphene capacitor, preferably in very low salt conditions. Enhanced persistence length of DNA in these conditions (rigidified DNA) should significantly prolong the translocation time. This might allow for the detection of sequence related variations in the capacitor/pore system impedance.

Achieving these goals demands from us to coordinate several well-equipped and staffed laboratories at IphyZ: Scanning probes Lab, X-ray scattering Lab and Lasers for applications Lab. Enhanced activity focus and the training by EPFL will lead us to fulfill a broader objective: our Labs will become capable to support Croatian research community and industry in the studies of systems much more diverse than those addressed in this project.