

Infrastructure for Nanostructures and Femtoscience



Created by the INRS Energy, Materials and Telecommunications, the Infrastructure for **Nanostructures and Femtoscience (INF)** brings under the same roof two complementary installations, a combination unique in Canada, and consisting of the following :

- **LMN (Laboratory of Micro and Nanofabrication)** a facility which makes it possible to probe and exploit the infinitely small, while meeting the needs for several sectors of high technology related to the synthesis of nanomaterials and the fabrication of nanostructures for prototype devices.
- **ALLS (Advanced Laser Light Source)** a facility whose mission is the exploration of the physicochemical processes of matter at molecular scales by means of femto- and attosecond light sources, offering as well a unique capacity for innovation in the field of the high-speed instrumentation and in imagery for biomedical applications.

Infrastructure for Nanostructures and Femtoscience  
(LMN-ALLS)

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Infrastructure for Nanostructures and Femtoscience



Laboratory of Micro  
and Nanofabrication



*The infinitely small*

*& The infinitely fast*



### An international outreach

The LMN is an integrated laboratory of micro- and nanofabrication which involves an investment of more than 33 M\$ and includes three complementary research and development units:

- lithography (electrons and photons)
- thin films and nanomaterials synthesis, nanometric etching, ionic implantation and surface treatments
- characterization of nanomaterials and nanodevices.

By nature, the LMN meets the needs of the latest research in the fields located upstream and downstream from the realization of nanodevices, making it possible for the scientific community to test new concepts into nanophotonic, nanoelectronic and biomedical.

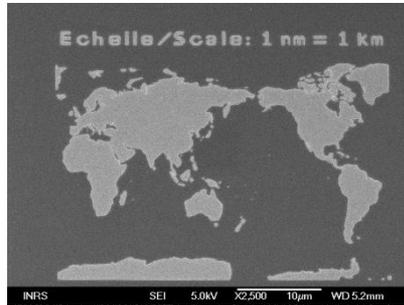
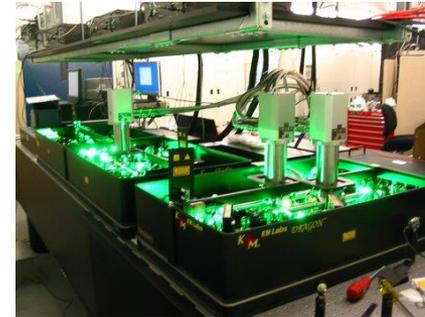


Chart of the world to the 1/1.000.000 000.000e realized with VB6 UHR EWF of Raith, a unique tool of electron beam lithography in Canada.

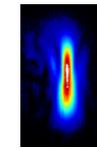


The ALLS (Advanced Laser Light Source) facility was one of the three Canadian projects subsidized within the framework of the Funds of international projects of the Canada Foundation for Innovation (CFI), and consists of a national laboratory of multi-beam femtosecond laser systems.

### A unique infrastructure

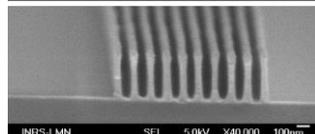
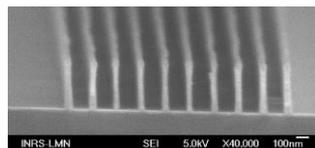
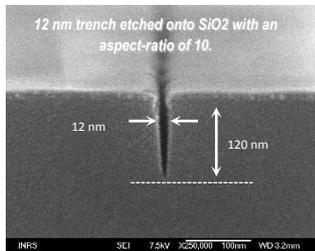


The multi-Khz chain can produce pulses of 5 mJ in 25 femtoseconds at a repetition rate of 5 KHz. An optical parametric amplifier (OPA) of high effectiveness is coupled with this chain in order to generate pulses of high average power with wavelengths ranging from 0.4 μm and 10 μm.



The central concept of the ALLS facility is to use a plurality of laser interactions, spanning from the X-ray to the infrared spectral ranges

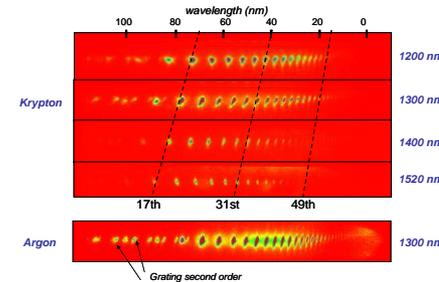
with sufficient peak power to manipulate matter at will and probe its dynamics. At the heart of the ALLS facility is a state of the art multiple-line laser systems using Ti:Sapphire ultrashort pulsed technology. Various sources of light contribute to a multiple-beamline "rainbow" which emit high intensity pulses with femto- and attosecond duration at various wavelengths.



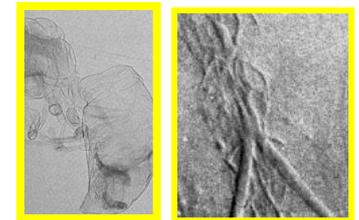
35nm lines spaced 145nm & 60nm lines spaced 60nm made of 300nm thick Tungsten on Si for Zone-Plate applications.

The access to the LMN is also crucial for the researchers implied in the general field of the synthesis and/or the characterization of nanomaterials for applications in other sectors, namely in tribological coatings, energy, environment, etc.

The LMN is without a doubt the only infrastructure in Canada which makes it possible to meet all the needs in nanostructures fabrication. In particular, the LMN places at the disposal of the scientific and technological community, an electron beam lithography system unique in its kind in the Canadian academic world.



Attoseconde dynamics of complex molecular systems can be obtained by probing the collective or correlated displacements of electrons on the attoseconde line.



Radiography of a bee and angiography (details) obtained by X-ray phase contrast on the imagery line and ultra-short X-ray absorption.

The infrastructure includes many laser systems accessible to the scientific community: the multi-Khz, 100Hz/4TW, 10Hz/10TW and 200TW laser chains, the imagery and ultra-short X-ray absorption beamline, high field beamlines, THz with high peak power and attosecond beamlines, as well as the laser induced electron diffraction beamline.