

SCIENTIFIC COOPERATION AGREEMENT

between

INSTITUTE OF LASER PHYSICS
Siberian Branch of Russian Academy of Science
13/3, Pr. Acad. Lavrentyev
630090 Novosibirsk, RUSSIA

and

LABORATOIRE DE PHYSIQUE DES LASERS
Unité Mixte de Recherche n°7538
Université Paris 13, Sorbonne Paris Cité et CNRS
Institut Galilée, 99 av. J. B. Clément
93430 Villetaneuse, France

1. Background

Laser physics brought new developments in many areas of science and applications. Large number of the advances has been achieved in the fields of atom optics, ultra high resolution molecular and atomic spectroscopy and fundamental optical metrology. Both institutes involved in the present cooperation agreement (the "**Laboratoire de Physique des Lasers**" de l'Université Paris 13 (Villetaneuse) - **LPL**; the "**Institute of Laser Physics**" of the Siberian Branch of the Academy of Sciences (Novosibirsk) - **ILP**) play an important role in these areas and have many years of successful experience in these fields.

The informal contacts, developed since 1972 through visits and research exchanges, have resulted in remarkable achievements like, for instance, development of the iodine molecular interferometer and ultrahigh Raman molecular spectroscopy, precision measurements of molecular constants, development of new methods of laser metrology and optical frequency measurements with femtosecond laser based transfer oscillator. A first cooperation agreement between **Laboratoire de Physique des Lasers** and **Institute of Laser Physics** was established in 1991 to intensify exchanges and common projects, then renewed in 1994, 1999, 2002, 2005 and in 2012. The success of this cooperation played an important role in the development of a new stage of the French-Russian cooperation in the field of Laser Physics.

2. Objective of the Cooperation agreement

The aim of this project is to:

- Coordinate these research programmes in view of avoiding duplication of efforts, unless duplication is of scientific interest.
- Exchange experiences, approaches and methods of research, which could lead to common publications

- Facilitate visits of research people, Ph.D. students, enforce common appliance to international grants on subjects of common interest, organize common workshops and seminars.
- Carry out joint experimental research with experimental setups from both sides.

Emphasis could be put in the following directions:

- Ultrahigh resolution spectroscopy and its applications to precision measurements in fundamental physics.
- Atomic and molecular optics.
- Absolute optical frequency measurements and links with femtosecond frequency comb oscillators.
- Development of ultra-stable laser sources in UV, Visible and IR.

3. Schedule.

The previous cooperation agreements resulted in strong scientific cooperation through the privilege participation in the MPLP's workshops organized in Novosibirsk, the organization of series of French-Russian and Russian-French Laser Symposiums, short or long visiting stays (Prof. S. Bagayev, Dr. A. Goncharov, Dr. M. Skvortsov), in outstanding results concerning the development of new frequency references in visible range the development of atom and molecular interferometry experiments, the operation of ultra-stable laser sources in visible and infrared domain and their absolute frequency measurement. It led to common scientific publications.

To intensify the cooperation the two parties conclude to develop a 3-year (2015-2017) program to carry out joint experiments in the field of optical frequency standards and femtosecond metrology - Métrologie, molécules et tests fondamentaux (MMTF) group in LPL (leaders - A. Amy-Klein, Ch. Chardonnet) and atom interferometry and laser spectroscopy group in ILP (leaders - A. Goncharov, M. Skvortsov)

The following tasks for the experimental projects are pointed out

- 1) Development of compact frequency stabilized laser systems based on solid state and diode lasers for high resolution spectroscopy and metrology applications. This will include the study of iodine stabilized Yb:KYW/YAG laser system for secondary frequency standards and the development of compact diode pump solid state and amplified diode laser systems for high resolution spectroscopy of cooled Mg atoms and the study of QCL (Quantum Cascade Laser) for high resolution spectroscopy in mid-infrared domain.
- 2) Development of methods and technique for trapping and laser cooling of neutral atoms down to ultralow temperature.
- 3) Study and application of optical frequency comb synthesizers based on femtosecond lasers for precision measurements and comparisons of optical frequencies.
- 4) Development of methods and technique for ultra-stable frequency dissemination and long distance frequency comparison of frequency standards.

4. Support

To implement and develop these projects and to carry out joint research work, it will be necessary to organize missions and to support the exchange of visiting scientists. A total number of 12 months of exchanges has to be considered as essential. The cooperation will also strongly benefit from long-period visits. It would be also of high interest to conclude some specific partnership for students at the thesis level.

Except the financial resources of the labs involving in this cooperation, the financial supports of the cooperation program are expected from French embassy, Siberian Branch of Russian Academy of Sciences, Russian Foundation for Basic Research.

Villetaneuse, March 31, 2015

Dr S. N. BAGAYEV

Academician of Russian Academy of Sciences,
Director of the Institute of Laser Physics,
Siberian Branch of Russian Academy of Sciences
RUSSIA



Olivier Gorceix

Olivier Gorceix
Directeur du Laboratoire
de Physique des Lasers

Professeur à l'Université Paris 13
Directeur du Laboratoire de Physique des Lasers
Université Paris 13 - CNRS
FRANCE