COHERENT OPTICS SENSORS FOR MEDICAL APPLICATIONS (COSMA)

Project financed by the EC (7th FWP)

Duration of the project: 2012 – 2016

Project Partners:

1. University of Siena - Department of Physics - Italy
2. Swansea University - College of Human and Health Sciences - UK
3. University College London - Department of Physics and Astronomy - UK
4. Bulgarian Academy of Sciences - Institute of Electronics - Bulgaria
5. Bar-Ilan University - Department of Chemistry - Israel
6. Jagiellonian University - Department of Physics - Poland
7. National Academy of Sciences of Armenia - Institute for Physical Research - Armenia
8. Siberian Branch of Russian Academy of Sciences - Institute of Automation and Electrometry - Russia
9. University of Calcutta - Department of Physics - India
10. University of California at Berkeley - Department of Physics - USA

The Project aims to develop a class of optical atomic magnetometers (OAMs) specifically designed for medical applications, namely: direct detection of magnetic fields from the human body through real-time and/or multichannel magnetocardiography; detection of signals in ultra-low-field nuclear magnetic resonance (NMR) and in magnetic-resonance imaging (MRI). The project is being implemented with the participation of ten research groups from Italy, the United Kingdom, Bulgaria, Israel, Armenia, Russia, India, Poland and the USA.

Transfer of knowledge will be carried out to develop OAMs for clinical use, to train young researchers in the design of novel instrumentation for medical applications, to start a comprehensive and coordinated research activity aimed to make biomagnetism detection and analysis a very important health issue. The activity will specifically include tests of the magnetometers in hospital environment where magnetic-field-based diagnostics will be conducted. The ultimate achievable result of the collaboration will be to provide to every hospital and clinic access to biomagnetic diagnostics, which is not possible now with the very expensive SQUID-based diagnostics whose use is confined to a few major hospitals. This is not only because OAMs have potential for providing high-precision measurements, but they also do not require the cryogenic temperatures intrinsic for the SQUID operation nor a large budget. OAMs make it possible to achieve a much smaller size of the sensor, leading to better spatial resolution and better coupling between the sensor and the sample. Moreover, an original approach will be adopted that consists of compensating rather than screening spurious magnetic fields. This eliminates the need for an expensive mu-metal isolated room, which will be replaced by coils powered by advanced electronic equipment suitable for ultra-low-noise current generation and active control of the atomic Larmor frequency.