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Horizon 2020

Call: H2020-FETOPEN-2018-2020

(FET Open – Novel ideas for radically new technologies)

Topic: FETOPEN-01-2018-2019-2020

Type of action: RIA

(Research and Innovation action)

Proposal number: 828784

Proposal acronym: OXiNEMS

Deadline Id: H2020-FETOPEN-2018-2019-2020-01

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How to fill in the forms

The administrative forms must be filled in for each proposal using the templates available in the submission system. Some data fields in the administrative forms are pre-filled based on the steps in the submission wizard.

1 - General information

Topic FETOPEN-01-2018-2019-2020 Type of Action R/A

Call Identifier H2020-FETOPEN-2018-2020 Deadline Id H2020-FETOPEN-2018-2019-2020-01

Acronym	OXiNEMS
Proposal title	Oxide Nanoelectromechanical Systems for Ultrasensitive and Robust Sensing of Biomagnetic Fields

Note that for technical reasons, the following characters are not accepted in the Proposal Title and will be removed: < > " &

Duration in months	*48*

Please select at least three, but no more than six keywords (descriptors) that best characterise your proposal. Organize them in a descending order of relevance. The first three keywords should characterize the main scientific areas in the proposal and the additional ones could be secondary or application oriented. Note that the descriptors will be used to identify the most appropriate evaluators for your proposal.

Descriptor 1	**Discipline:** Physical sciences **Subdiscipline:** Nanophysics, nanoelectronics, nanophotonics, nanomagnetism, nanoelectromechanics, etc. **Descriptor:** Nanoelectromechanics
Descriptor 2	**Discipline:** Materials engineering **Subdiscipline:** Materials engineering **Descriptor:** New materials, oxides, alloys, composite, organic-inorganic hybrid, nanoparticles
Descriptor 3	**Discipline:** Electrical and electronic engineering **Subdiscipline:** Electrical and electronic engineering **Descriptor:** Micro (system) engineering
Free keywords	*Oxide Electronics, MEMS, NEMS, optomechanics, magnetic field sensors, biomagnetism, thin films, resonators, Magnetoencephalography, Ultra Low Field Magnetic Resonance Imaging*

Abstract

In this project, we develop a new class of nanoelectromechanical systems (NEMS) based on integrated multifunctional oxides. With these devices, we will construct ultrasensitive and robust detectors for biomagnetism and apply them as transducers for applications in the field of human brain imaging. OXiNEMS will exploit advanced multifunctional materials, namely transition metal oxides (TMOs) to create new types of NEMS and MEMS devices based on crystalline heterostructures and revolutionize the field of M/NEMS across many areas of technology. As proof-of-concept of this innovative vision, OXiNEMS targets breakthrough research for developing nanomechanical sensors for measuring weak magnetic fields, in particular those found in Magnetoencephalography (MEG) and Ultralow-Field/Very-Low-Field (ULF/VLF) Magnetic Resonance Imaging (MRI). Presently available instruments are based on Low Temperature SQUID detectors which are extremely sensitive, but are mildly robust to static and pulsed magnetic fields, such as the ones used in ULF/VLF MRI and Transcranial Magnetic Stimulation (TMS), still not integrated with MEG. SQUIDs require expensive operation and maintenance costs, as they work in a liquid helium (4K) bath. OXiNEMS will develop robust magnetic field sensors based on nanomechanical resonators with all-optical readout, working in a simplified cryogenics setup at the liquid nitrogen temperature (77K). This allows for a much smaller working distance which enables biomagnetic detection with unprecedented spatial resolution. The success of OXiNEMS will thus both revolutionize the NEMS and MEMS field by introducing a new class of multifunctional sensors/actuators, and also it will open new directions in the field of human brain imaging by facing one of the most critical current challenges of neuroscience and the clinical community: to image brain activity and connectivity with high spatial and temporal resolution combining MEG with MRI and TMS on the same system.

Remaining characters 9

Has this proposal (or a very similar one) been submitted in the past 2 years in response to a call for proposals under Horizon 2020 or any other EU programme(s)? (•) Yes ( ) No

Please give the proposal reference or contract number.	
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