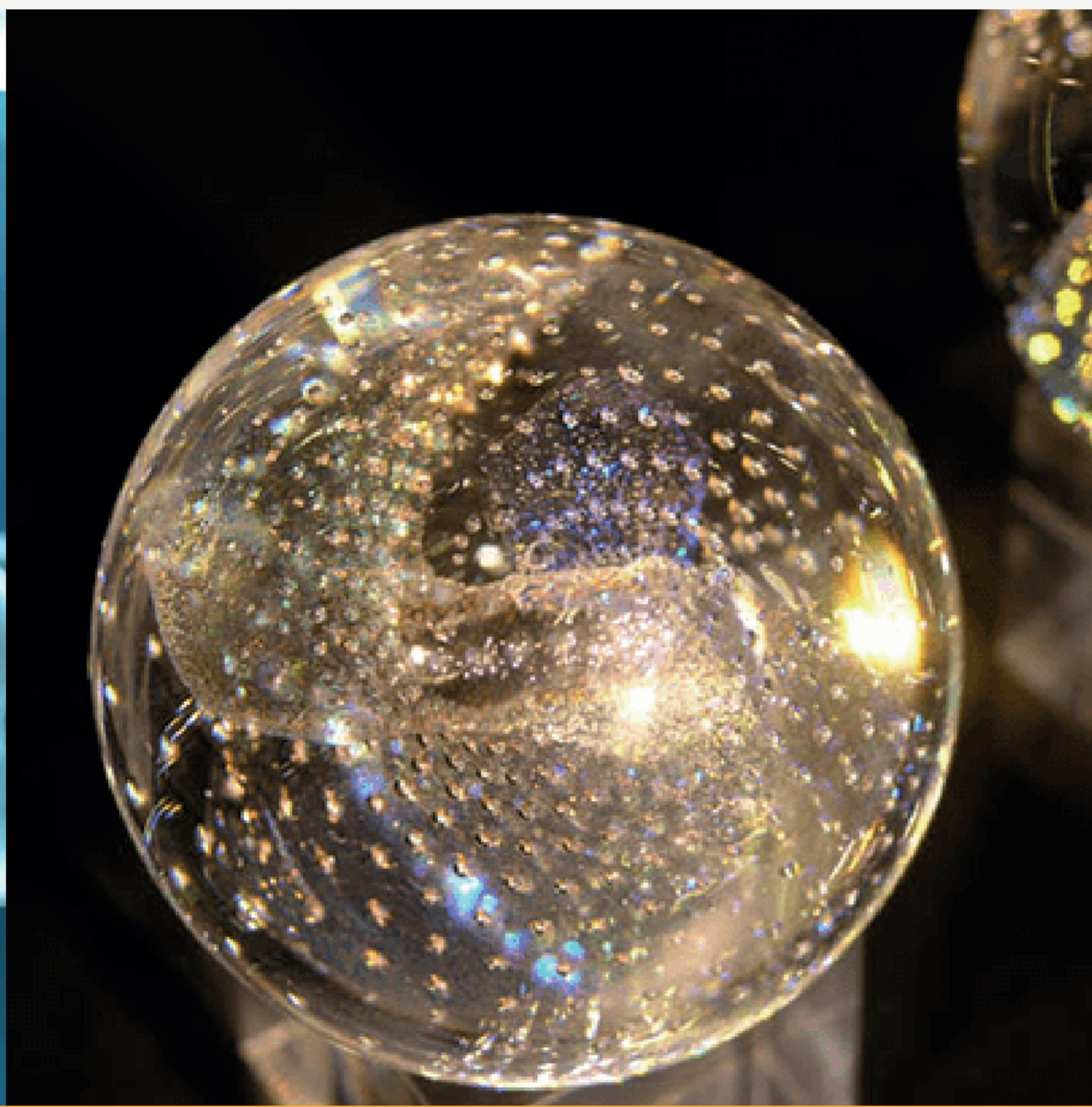


## THE PROJECT

**COgITOR** is a project funded under the topic H2020-FETOPEN-2018-2020 / H2020-FETOPEN-2018-2019-2020-01 programme, aiming at developing a liquid state cybernetic system prototype. Holonomic memory and computing, pressure sensing, and energy harvesting from thermal gradients will be achieved using colloids. The prototype will be tested in extreme environments for potential space applications.



## BENEFITS

The benefits of a base science research are for all the people. Inspiring new forms of art, of understanding, of conceiving a robot are among the expected benefits, as well as a deeper understanding of living organisms and their superior brain functions. The consortium will boost the European position in soft robotics and grant supremacy in liquid robotics.

## IMPACT

The project will create a liquid robot. It will “feel” the external environment like our skin, being sensible to pressure and temperature. It will be able to heal autonomously when wounded. A basic liquid memory and a rudimentary logic has already been demonstrated. It will produce a small amount of energy to “be alive”.

## RESULTS

The first experiments have explored so far the capabilities of colloidal suspensions at liquid state to undergo learning and memorization. Several media have been characterized, including ZnO, polyaniline nanorods and ferrofluids, and setting of internal states is obtained by applying an external stimulus, such as a quasi-steady state potential, while resistance or microwave impedance are monitored. Pavlovian learning in colloids has been demonstrated for the first time, enabling an innovative programming protocol in liquids. We have used titanium nitride colloids to develop a strong thermal gradient by photothermal effect, that will be exploited in future experiments to scavenge energy for partial powering of the liquid robot. The synthesis of BiFeO<sub>3</sub> has been validated for reproducibility. The material was made commercially available to the public through inclusion into the catalogue of nanomaterials by PlasmaChem. A novel concept of polymer bi-layer assembly with multi stimuli responsive properties has been demonstrated.