NEUTRAL MS

NEMS-BASED NEUTRAL MASS SPECTROMETRY FOR HIGH-MASS SPECIES

WHAT IS NEUTRAL MS?

CEA-Leti, in collaboration with CEA's Fundamental Research Division, developed a novel technology for mass measurement, filling a gap in mass of several orders of magnitude. So far, no commercial technology could directly measure the inertial mass of nanoscale objects in the megadalton (MDa) to gigadalton (GDa) range (1MDa–10GDa). With this new range, CEA-Leti's technology now enables characterization of most viruses, as well as synthetic nanoparticles for nanomedicine—virus like particles, protein nanoparticles, metallic or hybrid nanoparticles, etc.

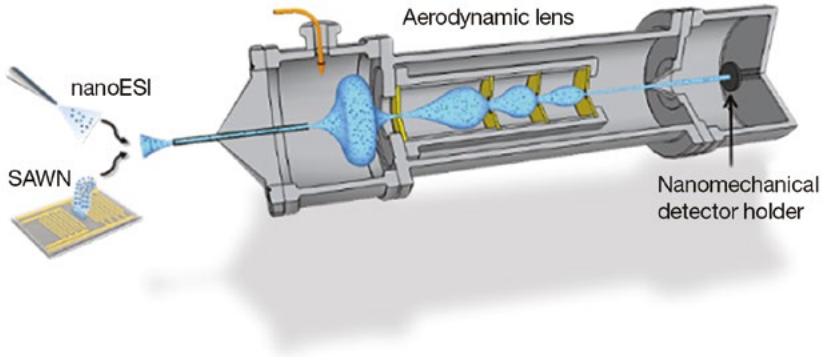
APPLICATIONS

CEA-Leti's NEMS-based neutral mass spectrometry solution will fuel discoveries in biological and biomedical science such as:

- Analytical instrumentation for biological or synthetic nanoparticles
- Biotechnology: nanoparticles for drug delivery or anti-tumoral therapy
- Virology
- Pharmaceutical industry (quality control)
- Cosmetic industry
- Environment, air quality control
- Food industry

WHAT'S NEW?

Neutral MS relies on nanomechanical resonator arrays, with doubly clamped nanoscale beams actuated at their resonance frequencies. Biological or synthetic particles landing on the device shift the frequency by an amount which is proportional to the particle mass. Real-time frequency tracking of the device enables real-time mass spectrometry with single particle resolution.

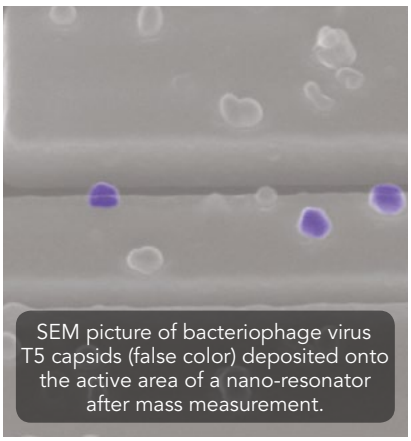


WHAT'S NEXT?

The joint CEA-Leti and CEA's Fundamental Research Division team is currently working on decreasing time of analysis from several hours down to a few minutes by increasing the density of the nanoresonator array (from 20 to >1000 NEMS within an array). Team is also working on improving the sensor design to enable the analysis of a greater variety of particles, including those featuring irregular shapes (large aspect ratio).

KEY FACTS:

- Patent portfolio on NEMS technology and system architecture
- Publication: "Neutral mass spectrometry of virus capsids above 100 megadaltons with nanomechanical resonators" Dominguez-Medina et al, Science 362, 918-922 (2018)



SEM picture of bacteriophage virus T5 capsids (false color) deposited onto the active area of a nano-resonator after mass measurement.

INTERESTED IN THIS TECHNOLOGY?

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