Research team refines NMR analysis apparatus by a factor of twenty thousand

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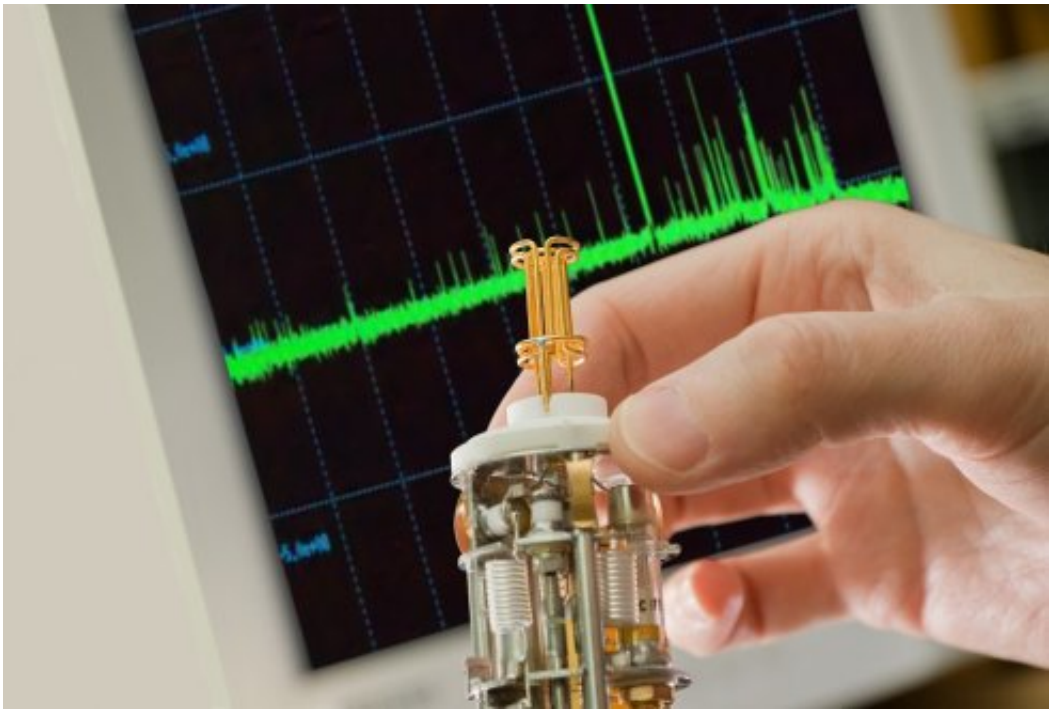

An international team of researchers has greatly expanded the potential for NMR analysis apparatus. They have made it possible to measure all the signals of a substance with a single, newly developed miniature antenna, while in current equipment several – very expensive – antennas are needed to do so. Moreover, only a few nanolitres of a substance are needed to conduct measurements. Previously, half a millilitre was

required. The broadband mini-antenna, with a reduction factor of 20,000, provides unprecedented possibilities for using NMR in scientific research.

Nuclear Magnetic Resonance (NMR) spectroscopy (related to Magnetic Resonance Imaging – MRI– the widely used medical imaging technology) is one of the most powerful analytical technologies for molecular research. Because the various atoms in a molecule each have specific vibrational frequencies, NMR technology can conclusively establish the identity of a molecular structure. The mini antenna, developed by the research team of scientists from Wageningen University, the University of Twente and institutions in Spain and Italy, has a much broader frequency range than the existing apparatus. With this new antenna, the NMR frequencies of all elements can be measured simultaneously, which makes the apparatus not only much easier to use, but also much less expensive.

NMR spectroscopy is crucial to many fields of research, such as in determination of the structure of proteins, in drug research, for developing new materials and optimisation of catalysts. The Netherlands take a leading position in worldwide NMR research. For example, the national NMR-NL consortium (where the universities of Eindhoven, Leiden, Nijmegen, Utrecht and Wageningen join forces) develops state-of-the-art apparatus and applications. The innovative miniature antennas can be used in current and future NMR apparatus, and can also be used in the development of miniaturised NMR equipment.

Molecules consist of atoms of various elements (such as hydrogen, carbon, oxygen, fluorine or phosphorus). In classical NMR apparatus, to measure an element a special antenna must be tuned to the specific frequency of that element. It is analogous to a radio: to listen to a specific radio station (in this analogy, 'an element'), the radio must be tuned precisely to the frequency of that station. With the new

mini-antenna, however, it is possible to 'listen' to all frequencies simultaneously. Although listening to all radio stations simultaneously would not be ideal for radio, this innovation provides many new possibilities for studying molecules with NMR apparatus.

More information: Raluca M. Fratila, M. Victoria Gomez, Stanislav Sykora & Aldrik H. Velders. "Multinuclear nanoliter one-dimensional and two-dimensional NMR spectroscopy with a single non-resonant microcoil." *Nature Communications*, January 2014. DOI: 10.1038/ncomms4025

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