New Alzheimer's research method uses muons

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Swiss Light Source. Credit: Leiden University

Alzheimer's disease is the most common form of dementia. This makes fundamental research on the precise cause of the illness of vital importance. One of the possible suspects is a certain protein filled with iron. Leiden physicist Lucia Bossoni (LION/LUMC) has now developed a new way of investigating this protein, with the help of subatomic particles called muons.

Muons are elementary particles and the main product of cosmic rays, which fly in from space and reach sea level at a rate of ten thousand hits per square meter, every minute. Decades ago, scientists figured out a

way to artificially produce intense beams of muons, by firing protons into a graphite target to create pions, which finally decay into positively charged muons. Researchers then guide these muons in a beam, which they can use to fire on a sample of their interest. These special muons possess a specific property: they are 100% spin-polarized, meaning that they behave as tiny compasses.

When muons hit a material, their spin can feel the internal magnetic field of a sample and they start spiraling around it. The muons quickly decay into other particles, with a preferential direction related to the muon's spin. So by looking at this direction, scientists gain information about the internal magnetic field. Bossoni and her colleagues in Leiden have now used this method to look into the magnetic properties of the iron core of ferritin—a protein that they isolated from the brain of an Alzheimer patient and a control subject. The composition of the mineral core of ferritin is thought to be altered in patients suffering from Alzheimer's disease. The preliminary results show a difference between 'healthy' ferritin proteins and ferritin inside Alzheimer patients' brains.

Bossoni: 'Apart from the method's applicability in Alzheimer's research, our study also paves the way for other medical research with muons. Up until now, muons have been mostly used on non-human material, for example to study superconductors and synthetic magnetic compounds.'

More information: Lucia Bossoni et al. Human-brain ferritin studied by muon spin rotation: a pilot study, *Journal of Physics: Condensed Matter* (2017). DOI: 10.1088/1361-648X/aa80b3

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