WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 15, 525-527. Short Communication ISSN 2277–7105

# MEASURING NMR SPECTRA OF ZERO-SPIN NUCLEI

**Abdullatif Azab***

Eastern Plants Company, Box 868, Arara, Israel 30026.

Article Received on
11 June 2025,

Revised on 01 July 2025,
Accepted on 21 July 2025,

DOI: 10.20959/wjpr202515-37773

***Corresponding Author**
**Abdullatif Azab**
Eastern Plants Company,
Box 868, Arara, Israel
30026.

## ABSTRACT

NMR spectroscopy is one of the most powerful analytical methods. Along with its crucial in Chemistry, it has extremely wide applications in all science fields and medicine (MRI). With the current knowledge and technology, it is not possible to measure NMR spectra for zero-spin nuclei. This is a severe limitation of the analytical method itself, and more important, to science, technology and medicine. In this communication we propose theoretical basis for activation of zero-spin nuclei, and consequently, enabling NMR spectra for compounds that contain them.

**KEYWORDS**: chiral center, polarized light, zero-spin nuclei, NMR spectroscopy, 12C, 13C.

**INTRODUCTION**: Nuclear magnetic resonance (NMR) spectroscopy is one of the most important analytical methods. Its uses are almost beyond count in all science disciplines. In medicine, magnetic resonance imaging (MRI) is top diagnostic tool. Despite all this, this spectroscopic method, and as a result all its uses, suffers a severe limitation in the current knowledge: it can not be applied and used for zero-spin nuclei.[1]

To demonstrate the severity of this limitation, let us consider the case of an isolation (or laboratory synthesis) of a new natural product. Suppose that this compound has very low concentration in its source. Since the compound is new, it has to be characterized with several analytical methods, with at least hydrogen and carbon NMR spectra, on the top of them. As for $^{1}H$, this is easy and possible since this isotope is the most abundant of hydrogen isotopes, around 99.99%, and it is non-zero spin, 1/2. As for carbon, the situation is entirely different. NMR spectrum can be measured only for $^{13}C$, also with nuclear spin of 1/2, but with natural abundance of 1.03%. The most abundant carbon isotope is $^{12}C$ is 98.97%, but with a nucleus of zero-spin, I=0. This means that its NMR spectrum cannot be measured.

In this communication we propose that using polarized radiation instead of the non-polarized radiation normally used in this method, will activate zero-spin nuclei, induce spin split and enable NMR spectra measurement (figure 1).[2]

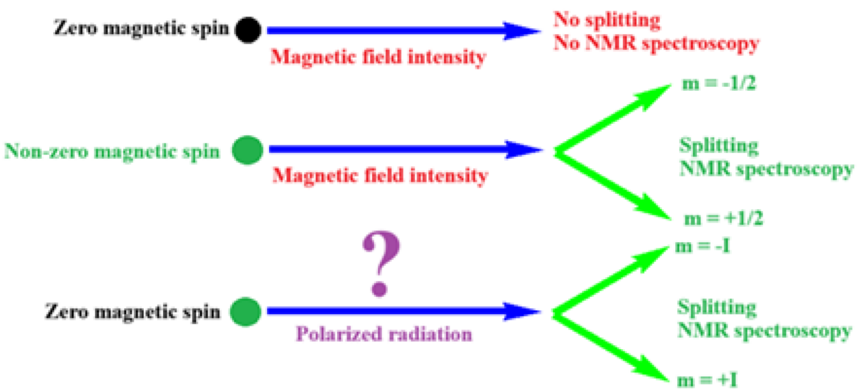


**Figure 1: Proposed use of polarized radiation will activate zero-spin nuclei.**

**Scientific Justification**: The interaction of light-matter is one of the most important phenomena in science and it had been utilized in numerous scientific fields. One of these fields is optical activity detection with polarized light.[3] In its most classical occurrence, plane polarized light interacts with a chiral center and its plane rotate in a specific angle. The most common case is the interaction of plane polarized light with two compounds with asymmetrical carbon (chiral center, enantiomers) resulting opposite rotations. These rotations are named specific rotation (angles), and they can be experimentally measured and theoretically calculated.[4]

But the presence of a chiral center is neither sufficient nor necessary since chirality can emerge from other structures, as shown in figure 2.[5,6]

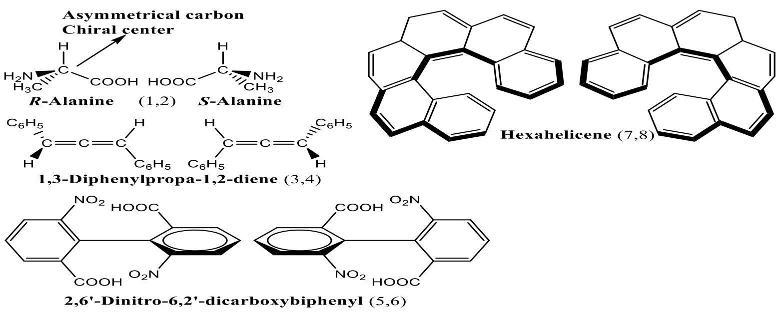


**Figure 2: Optically active compounds, with and without chiral centers.**

Moreover, it is now recognized that "new forces involve not only the chirality of the system on which they exert their mechanical action, but the chirality itself of the optical field that generate them".[7] Finally, it was recently reported that polarized light can polarize spins of electrons in indium selenide.[8]

In conclusion, considering the presented above properties of polarized light, there is a logically based probability that polarized light can activate zero-spin nuclei and enable measuring their NMR spectra and other uses like MRI.

**REFERENCES**


1. Mitschke, N., Vemulapalli, S.P., Dittmar, T., NMR spectroscopy of dissolved organic matter: a review. Environ. Chem. Lett., 2023; 21: 689-723. DOI: 10.1007/s10311-022-01528-4
2. Kumar, L., Sindhu, A., An Overview of Nuclear Magnetic Resonance: A Review. Int. J. Eng. Manag. Res, 2023; 13: 154-158. DOI: 10.31033/ijemr.13.6.18
3. Lininger, A., Palermo, G., Guglielmelli, A., Nicoletta, G., Goel, M., Hinczewski, M., Strangi, G., Chirality in Light-Matter Interaction. Adv. Mater., 2023; 35: e2107325. DOI: 1.1002/adma.202107325
4. Tutunnikov, I., Steinitz, U., Gershnabel, E., Hartmann, J.M., Milner, A.A., Milner, V., Averbukh, I.S., Rotation of the polarization of light as a tool for investigating the collisional transfer of angular momentum from rotating molecules to macroscopic gas flows. Phys. Rev. Res., 2022; 4: 013212. DOI: 10.1103/PhysRevResearch.4.013212
5. Garner, M.H., Corminboeuf, C., Correlation between optical activity and the helical molecular orbitals of allene and cumulenes. Org. Lett., 2020; 22: 8028-8033. DOI: 10.1021/acs.orglett.0c02980
6. Lee, C., Weber, J.M., Rodriguez, L.E., Sheppard, R.Y., Barge, L.M., Berger, E.L., Burton, A.S., Chirality in Organic and Mineral Systems: A Review of Reactivity and Alteration Processes Relevant to Prebiotic Chemistry and Life Detection Missions. Symmetry. 2022; 14: 460. DOI: 10.3390/sym14030460
7. Genet, C., 2022. Chiral light–chiral matter interactions: an optical force perspective. ACS Photonics, 2022; 9: 319-332. DOI: 10.1021/acsphotonics.1c01130
8. Pasquale, Faria Junior, P. E. Feng, S., Collette, E., Watanabe, K., Taniguchi, T., Fabian, J., Kis, A., Spin polarization detection via chirality-induced tunnelling currents in indium selenide. Nature Materials, 2025; 24: 212-218. DOI: 10.1038/s41563-024-02067-9