

UC Berkeley

UC Berkeley Previously Published Works

Title

review of Miyanishi et al

Permalink

<https://escholarship.org/uc/item/7326z99m>

Author

Reimer, Jeffrey

Publication Date

2021-01-03

DOI

10.5194/mr-2020-36-rc1

Peer reviewed

Interactive comment on “Room temperature hyperpolarization of polycrystalline samples with optically polarized triplet electrons: Pentacene or Nitrogen-Vacancy center in diamond?” by Koichiro Miyanishi et al.

Jeffrey Reimer (Referee)

reimer@berkeley.edu

Received and published: 3 January 2021

The manuscript by Miyanishi et al describes phenomenology, and detailed analysis, of ^{13}C polarization enhancement by DNP in two systems: diamond and benzoic acid. The authors create athermal electron polarizations in electron triplet states via optical pumping, then drive that polarization to ^{13}C nuclei via the “integrated solid effect,” which in these cases means matching electron Rabi frequencies to nuclear Larmor frequencies. That the authors achieve modest polarizations on the ^{13}C reservoir is not surprising; this manuscript is particularly noteworthy in that the both the electron and

Printer-friendly version

Discussion paper



nuclear resonances are interrogated and that the detailed mechanism is revealed by a detailed model. Readers that are interested in the “physics” of DNP in an accessible and thoughtful paper need look no further than this work.

For the authors' consideration I include some comments below, though I am recommending the manuscript be published as is.

Lines 19-33: Often neglected in modern times is the extensive DNP work in “inorganic” semiconductors such as GaAs (conflict of interest: I am an author on some of these works). Deep conduction band photoexcited electrons, or photoexcited electrons captured at various defects, afford a surprising array of spin physics. . . I call attention to any of the papers by Meriles et. al. at CCNY.

Lines 54-56: Although later in the paper you press the advantage of photoexcited states for DNP, it might be worth emphasizing that point here: once the OP-DNP is accomplished, the effects of unpaired electron spins vanish and the full suite of high resolution solids NMR in diamagnetic materials becomes available.

Line 65: It is kind of the authors to call attention to the 2010 paper by King et al; though I note the mechanism by which nuclear hyperpolarization occurs in those high-field pumping experiments has not been ascertained.

Section 2.1 is particularly well written and accessible.

Section 4.1 and Figure 3: These EPR results are particularly compelling in making the case for the ISE mechanism.

Lines 162-163: I believe the shuttling experiments from Ajoy et al may be the first optically polarized and ^{13}C hyperpolarized measurements, albeit by shuttling the samples into a high field NMR system.

Line 199: It is interesting to compare the ^{13}C diamond T_1 values (~ 100 seconds) with those reported in <https://doi.org/10.1038/s41467-019-13042-3>. If I read the graphs correctly, the samples used in Ajoy et al have a T_1 value of ~ 50 seconds at that same

[Printer-friendly version](#)[Discussion paper](#)

field strength, consistent with the higher P1 spin density is the Ajoy samples.

Interactive comment on Magn. Reson. Discuss., <https://doi.org/10.5194/mr-2020-36>, 2020.

MRD

Interactive
comment

Printer-friendly version

Discussion paper

