Retraction

OUR REPORT “Single-proton spin detection by diamond magnetometry” (1) presents measurements on near-surface nitrogen-vacancy centers in diamond. In these measurements, we observed signals that showed all the characteristics expected from single-proton nuclei. This interpretation was based on the three criteria of the Zeeman effect, quantum-coherent coupling, and (in one occasion) on a before/after-type control experiment.

We have discovered a potentially serious issue with the main conclusion in the paper, namely the “detection of a single-proton spin.” Specifically, we have recognized that resident carbon-13 nuclei within the diamond can mimic single-proton behavior, challenging our interpretation. Carbon-13 can produce quantum-coherent signals at the proton nuclear magnetic resonance frequency, and the scaling of frequency with magnetic field is indistinguishable from that of single protons within the measurement error. This behavior is due to an unrecognized effect that occurs with the dynamical decoupling sequence used for signal detection. We provide a detailed description of this behavior in a separate article (2).

Our Science Express Report claims single-proton spin detection in three instances. We find that two of these instances are ambiguous and can be explained by either single proton or single carbon-13, whereas the third instance can only be explained by single proton. Because this is only a single data point, we are not confident that it provides sufficient basis to support our claim of “single-proton spin detection.” We therefore retract the Report.

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References


Protecting coffee from intensification

SUSTAINABLE AGRICULTURAL intensification is one approach to meet food security and biodiversity conservation goals simultaneously (1, 2). The yield increases required to achieve these goals can be facilitated by using improved crops (3, 4). Pest-resistant or high-yielding crops may deliver higher returns than unimproved crops and thus alleviate pressures on remaining natural habitats. However, because higher yields increase household income, such improved crops may also incentivize farmers to expand cropland, which negatively affects biodiversity and ecosystem services. Arabica coffee, which is one of the most valuable agricultural commodities in the world, exemplifies this problem.

Wild Coffea arabica is a shrub native to the understory of the moist evergreen Afromontane forest of Ethiopia and is the ancestor of all commercial Arabica cultivars worldwide. In its region of origin, arabica coffee was originally harvested from wild populations, but over time, shade trees and coffee shrubs have been increasingly managed by farmers to increase coffee yields (5). Increased coffee yields improve local livelihood, but unfortunately the intensification of coffee agriculture is also degrading forest and causing severe biodiversity losses (6, 7). Even more important, excessive forest management and the use of locally improved arabica coffee cultivars are threatening the mating system and the genetic resources of wild Coffea arabica. Past and ongoing conversion of natural moist evergreen forest to heavily managed forest has already resulted in decreased pollen dispersal and increased self-pollination in wild arabica stands (8), and the original coffee gene pool already shows signs of admixture with cultivars (9). To date, three forests with wild Coffea arabica populations have been designated as UNESCO Biosphere Reserves in Ethiopia and a few others are proposed as reserves, but there are currently no guarantees that the genetic integrity of any of these populations will be maintained.

If the worldwide coffee industry plans to use the genetic diversity of the Ethiopian wild coffee to adapt arabica coffee to climate change and emerging pests and diseases (10, 11), more conservation efforts in the Ethiopian coffee forests are urgently needed. The ongoing conversion of the last remaining wild coffee populations to managed agroforests must be halted to conserve wild coffee and its pollinators, and the use of improved cultivars in the immediate vicinity of these populations must be discouraged to avoid introgression of cultivar genes into the wild arabica gene pool.

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References


Measuring merit: Take the risk

I AGREE WITH M. McNutt that young scientists should be evaluated on the basis of their willingness to take risks
How do we encourage youngsters to pursue their passion and dreams, which may not materialize in the short time frame of a Ph.D. or postdoc period? McNutt’s proposal should be seriously investigated by universities and funding agencies.

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Moving toward data on soil change

IN THE NEWS FEATURE “Rare earth” (7 November 2014, p. 692), M. Tennesen reports that soil scientists are focused on documenting and preserving soil diversity. However, the central challenge is not simply identifying endangered soils, but understanding, documenting, and responding to all soil change. The U.N. Intergovernmental Technical Panel on Soils’ forthcoming report (1), mentioned in Tennesen’s article, aims to document global soil change and its impact on soil and ecosystem function and service delivery. This effort is challenging, given the lack of data documenting decadal soil change. A single survey identifying endangered soils is of intellectual and scientific interest, but focusing resources on delineating rare soil boundaries, at increasing resolution, could be a distraction when we lack data on regional and global soil change resulting from climate and land use.

We need new monitoring approaches like the ecosystem approach implemented in the United Kingdom’s Countryside Survey (2,3). Similar monitoring, such as LUCAS in the European Union (4), provides vital data on the state and change of soils in an ecosystem context that can inform policy at national levels.

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REFERENCES
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