small proteins, high-frequency MAS NMR can potentially be used on much larger molecules. The main challenge is measurement sensitivity: The larger the protein, the fewer copies of it there are in a 0.5 mg sample, and the weaker the resulting signals. Doubling the size of the molecule under study would require an experiment four times as long. But each of Pintacuda and colleagues' structures was found with less than two weeks of data collection. There is plenty of room to expand.

Johanna Miller

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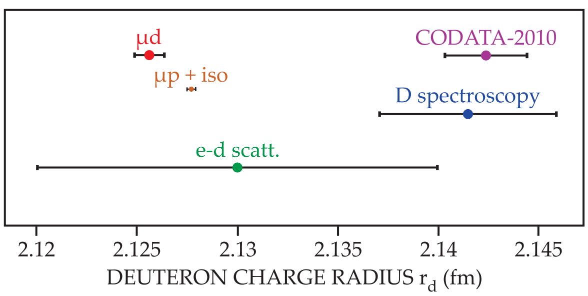
nanosecond pulses of −25 kV applied to a full-width electrode 4 mm above it triggered narrow plasma filaments known as streamers. To calculate the details of the streamers' propagation and interactions with the 400-μm-wide, 100-μm-thick biofilm, shown here in white, the researchers self-consistently accounted for 115 reactions involving 18 different chemical species, photoionization, and biofilm structure and conductivity. They found that localized ionization occurs above the biofilm, and the plasma spreads into the biofilm recesses. Although the biofilm's irregular shape may shield some nooks from reactive chemical species, diffusion between the plasma pulses evens out the distribution to a level that could satisfy decontamination thresholds. (H. Cheng et al., *Phys. Plasmas* **23**, 073517, 2016.) —RJF

DEUTERON JOINS PROTON AS SMALLER THAN EXPECTED

According to the international Committee on Data for Science and Technology (CODATA), the charge radius of the proton is 0.8768(69) fm. Few researchers would give that number much thought if not for measurements in 2010 and 2013 that yielded a radius 4% smaller than and 7.2 standard deviations distant from the CODATA value. Randolf Pohl of the Max Planck Institute of Quantum Optics in Garching, Germany, and colleagues obtained the curiously low radius after analyzing the energy-level shifts of muons orbiting hydrogen nuclei. With a mass 207 times that of the electron, a muon has a tighter orbital that more closely overlaps the nuclear charge distribution, which makes the negatively charged particle a useful tool for probing nuclear dimensions. The discrepancy between the results of muon-based and other experimental investigations has come to be known as the proton radius puzzle.



Now Pohl and his colleagues have used the same technique to measure the radius of the deuteron, a nucleus of one proton and one neutron. The researchers shot a beam of muons at a target of D_2 gas. Lasers excited some of the atoms whose electrons were replaced by muons and probed the muons' energy-level transitions. By combining the measurements with theory, the researchers came up with a deuteron charge radius of 2.12562(78) fm. That's 7.5 σ smaller than the CODATA value (see graph; the new result is in red). In addition, both the proton and deuteron sizes are in tension with the values obtained by applying the same technique to atoms with electrons rather than muons.

The new study reinforces the notion that something is amiss in our understanding of particle or atomic physics. The most tantalizing possibility is that the standard model is wrong—perhaps muons interact with other particles differently than electrons do, for example. Pohl considers that explanation unlikely. His group and others are conducting experiments to precisely measure the Rydberg constant, which, if favorably reevaluated, could resolve the discrepancy. (R. Pohl et al., *Science* **353**, 669, 2016.) —AG

UNRAVELING THE JET-LAG ASYMMETRY

Jet lag, the sluggishness we feel after landing in a new time zone, has a directional bias: Studies suggest it takes longer to recover from eastward travel than from westward travel. A new model developed by Michelle Girvan, Edward Ott, Thomas Antonsen, and colleagues at the University of Maryland, College Park, may explain why. The team used tools of nonlinear dynamics to model a region of the brain known as the suprachiasmatic nucleus (SCN), a network of roughly 20 000 time-keeping neurons devoted to maintaining the body's circadian rhythm. Jet lag happens when those neurons fall out of sync with the local cycle of night and day. Modeling the dynamics of the SCN, however, is a tall order. Although the neurons all take cues from the same source—the retina—they don't all respond in the same way. Nor do they share the same natural oscillation periods; absent visual cues, the periods of the average person's SCN neurons would be distributed around an average value slightly longer than a day—about 24.5 hours. In 2008 Ott and Antonsen devised a way to represent such heterogeneous networks of oscillators in terms of just a few key variables. Now they've applied that approach to the SCN. Their model predicts that the slight deviation of the neurons' natural periods from 24 hours can lead to large recovery-time asymmetries. The worst-case scenario turns out to be an eastward trip across nine time zones: An Angeleno arriving in Paris would require six more days to recover than would a Parisian landing in Los Angeles. (Z. Lu et al., *Chaos* **26**, 094811, 2016.) —AGS PT