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Dynamic nuclear polarization of high-density atomic hydrogen in solid mixtures of molecular hydrogen isotopes

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Abstract

© 2014 American Physical Society. We report on magnetic resonance studies of high-density atomic hydrogen and deuterium in solid hydrogen matrices at temperatures below 1 K. Average concentrations of H atoms ≈3×1019 cm-3 are obtained in chemical tunneling reactions of isotope exchange with D atoms. The products of these reactions are closely located pairs of H atoms near D2 molecules with strong exchange interactions. We discovered a dynamic nuclear polarization effect on H atoms created by pumping the center of the H electron spin resonance spectrum, similar to the Overhauser effect in metals. Our results indicate that H atoms may be arranged inside molecular matrices at separations equivalent to local concentrations of 2.6×1021 cm-3. This opens up a way to build a metallic state of atomic hydrogen at zero pressure.

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