Using bound exciton transitions to optically resolve neutral donor hyperfine states of various donor species in Silicon-28 JEFF SALVAIL, PHILLIP DLUHY, KAMYAR SAEEDI, Simon Fraser University, MICHAEL SZECH, Technische Universitaet Muenchen, HELGE RIEMANN, NIKOLAI ABROMISOV, Leibniz-Institut fu?r Kristallzu?chtung, PETER BECKER, PTB Braunschweig, HANS-JOACHIM POHL, VITCON Projectconsult, MICHAEL THEWALT, Simon Fraser University — Phosphorus in silicon is established as a promising resource for use in quantum information processing tasks. The neutral donor hyperfine states have been shown to have record long coherence times, high fidelity gates via RF pulses, and projective readout via optical bound exciton transitions. As Shannon's theory of information tells us, we can process more information in an alphabet of more symbols, so there is motivation to look at donors with higher nuclear spin than the $I = 1/2$ of ^{31}P, which provide access to Hilbert spaces of dimension greater than two. In this talk I will describe optical studies of the donors ^{75}As ($I = 3/2$), ^{121}Sb ($I = 5/2$), and ^{209}Bi ($I = 9/2$) in ^{28}Si.

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