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Fault-tolerant Quantum Communication Based on Solid-state Photon Emitters LILIAN CHILDRESS, Harvard University, ANDERS SORENSEN, Niels Bohr Institute, JACOB TAYLOR, Harvard University, PHILLIP HEMMER, Texas A&M, GURUDEV DUTT, ALEXANDER ZIBROV, MIKHAIL LUKIN, Harvard University — We describe a novel method for long distance quantum communication in realistic, lossy photonic channels. The method uses single emitters of light as intermediate nodes in the channel. One electronic spin and one nuclear spin degree of freedom associated with each emitter provide quantum memory and enable active error correction. We show that these two degrees of freedom, coupled via the contact hyperfine interaction, suffice to correct arbitrary errors, making our protocol robust to all realistic sources of decoherence. The method is particularly well suited for implementation using recently-developed solid-state nano-photonic devices, and we discuss preliminary experimental investigations using nitrogen-vacancy centers in diamond.

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