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External field control of spin-dependent insertion reactions at ultralow temperatures TIMUR TSCHERBUL, University of Nevada, Reno, JACEK KLOS, University of Maryland — We present an extension of the accurate coupled-channel statistical model (CCSM) of barrierless atom-molecule insertion reactions [1] to include the effects of the hyperfine structure of the reactants in the presence of an external magnetic field. We apply the extended CCSM to the chemical reaction $Li(^2S_0) + CaH(^2\Sigma^+) \rightarrow LiH(^1\Sigma^+) + Ca(^1S_0)$ on a newly developed set of *ab initio* potential energy surfaces of singlet and triplet symmetry. The calculated reaction cross sections below 100 mK are very sensitive to the initial Zeeman states of Li and CaH, opening up the possibility of controlling barrierless insertion reactions by tuning the hyperfine states of the reactants with an external magnetic field.

1. M. H. Alexander, E. J. Rackham, and D. E. Manolopoulos, J. Chem. Phys. **121**, 5221 (2004).

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