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How Hydrogen Terminated Diamond Acquires a Negative Electron Affinity Surface JONATHAN RAMEAU, JOHN SMEDLEY, ERIK MULLER, Brookhaven National Lab, TIM KIDD, University of Northern Iowa, PETER JOHNSON, Brookhaven National Lab — Electron emission from the negative electron affinity (NEA) surface of hydrogen terminated, boron doped diamond in the [100] orientation is investigated using angle resolved photoemission spectroscopy (ARPES). ARPES measurements using 16 eV synchrotron and 6 eV laser light are compared and found to show a catastrophic failure of the sudden approximation. While the high energy photoemission is found to yield little information regarding the NEA, low energy laser ARPES reveals for the first time that the NEA results from a novel Franck-Condon mechanism coupling electrons in the conduction band to the vacuum. The result opens the door to the development of a new class of NEA electron emitter based on this effect.

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