121 Electronic Structure of the Silicon Vacancy Color Center in Diamond

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The negatively charged silicon vacancy (SiV) color center in diamond has recently proven its suitability for bright and stable single photon emission. However, its electronic structure so far has remained elusive. We here explore the electronic structure by exposing single SiV defects to a magnetic field where the Zeeman effect lifts the degeneracy of magnetic sublevels. The similar responses of single centers and a SiV ensemble in a low strain reference sample prove our ability to fabricate almost perfect single SiVs, revealing the true nature of the defects electronic properties.

We model the electronic states using a group-theoretical approach yielding a good agreement with the experimental observations (see figure 1). Furthermore, the model correctly predicts polarization measurements on single SiV centers and explains recently discovered spin selective excitation of SiV defects.

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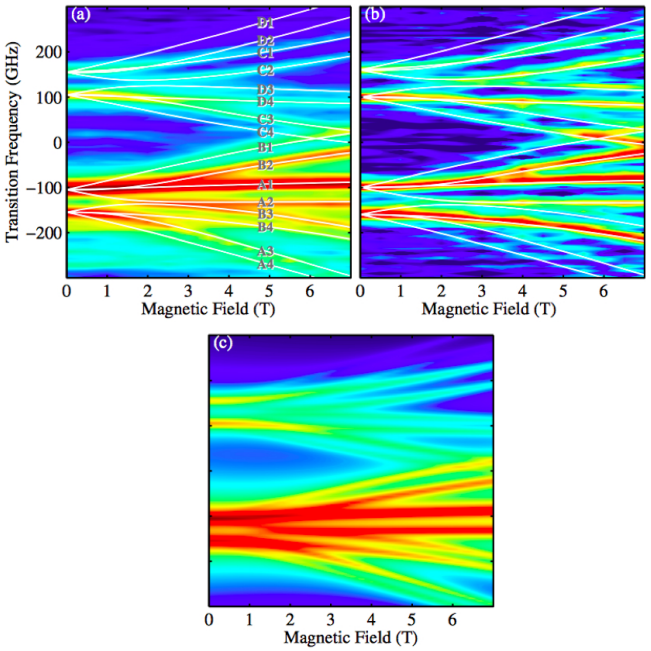

Fig. 1 *Spectral fine structure splitting of* ***(a)*** *a SiV^- ensemble (contour plot, color coding indicates peak intensity in logarithmic a.u.) and* ***(b)*** *single SiV^- defect vs applied magnetic field [in the (001) direction]. White solid lines are calculated transitions based on the model mentioned in the text. Panel* ***(c)*** *displays a simulation of the fine structure lines intensity assuming dipolar transitions.*

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