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Polarization spectroscopy of defect-based single photon sources in ZnO[1] NICHOLAS JUNGWIRTH, HUNG-SHEN CHANG, MINGDE JIANG, GREGORY FUCHS, Cornell University — Isolated point-defects in wide bandgap semiconductors are promising candidates for future applications requiring quantum light sources. Recently, defect-based single photon sources have been observed in ZnO that are very bright (>100 kCounts/s) and remain photoactive from 4.5 K to room temperature. Despite several investigations, the structure and electronic states of these emitters remain unknown. In this work, we establish a procedure to distinguish a Z dipole from an XY dipole when studying quantum emitters that are randomly oriented. Our cryogenic and room temperature polarization measurements collectively establish that these unidentified ZnO quantum emitters have a Z dipole. We show that the associated absorption and emission dipoles are parallel within experimental uncertainty for all 32 individuals studied. Additionally, we apply group theory and find that, assuming the defect symmetry belongs to a point-group relevant to the ZnO wurtzite lattice, the ground and excited states are orbital singlets. These results are a significant step in identifying the structure and electronic states of defect-based single photon sources in ZnO.

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