



Extended Data Figure 11 | Predicted exciton spectra and polarization properties for individual perovskite nanocrystals. The plots show the expected exciton fine structure in photoluminescence spectra from three orthogonal dipoles of the lowest-energy exciton. The dipoles are oriented along the orthorhombic symmetry axes. The insets show the emission probability for the dipoles as a function of the polarization angle. **a–d**, Expected fine structure for observation in the [010], [001], [011] and [312] directions with respect to the orthorhombic symmetry axes,

respectively. The temperature effect on the population of the sublevels is not considered (that is, the populations of the sublevels are assumed to be equal). **e–h**, As in **a–d**, but taking the temperature effect on the population of the sublevels into consideration. The temperature is assumed to be comparable to the fine-structure splitting: $k_B T \approx \Delta_1 = \Delta_2$, where k_B is the Boltzmann constant and T is temperature. See Supplementary Information section 4 for further details.