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Temperature-dependent single-molecule spectroscopy of plant protein aggregates

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Plants live with a continuous paradox: while light is the lifeblood for their growth, too much light can be extremely harmful. Their photosynthetic machinery, therefore, regulates the amount of absorbed energy in a photoprotective process known as non-photochemical quenching (NPQ). Aggregation of the main light-harvesting complex of plants, LHCII, is considered an excellent model system for the major component of NPQ. We performed a temperature-dependent (down to 4 K) single-molecule spectroscopy study of two types of LHCII aggregates to resolve their spectroscopic heterogeneity. We discovered that exciton annihilation is severely underestimated in steady-state bulk studies of LHCII aggregates and explains the varying spectral shapes in different time-resolved bulk studies.

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