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Supplementary Materials for

Long-range coupling of electron-hole pairs in spatially separated organic donor-acceptor layers

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The PDF file includes:

Figures S1-S7:

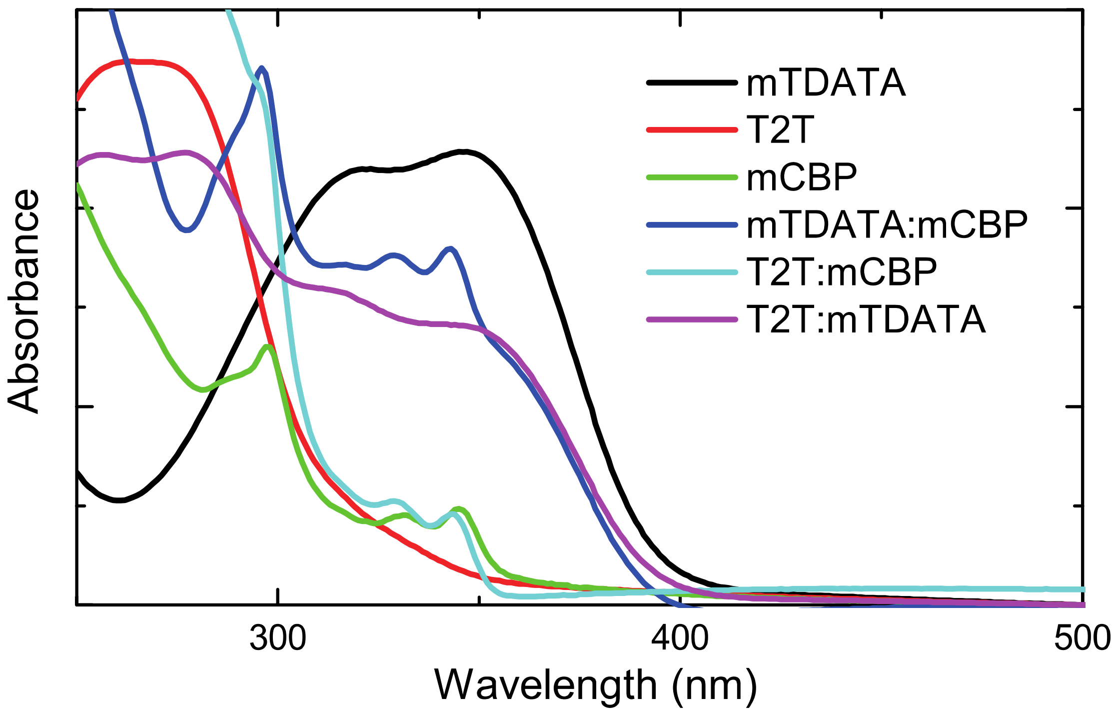

Figure S1: Ground state absorption spectra of 50-nm-thick D, A, S, 50wt%-D:S, 50wt%-S:A, and 50wt%-D:A thin films.

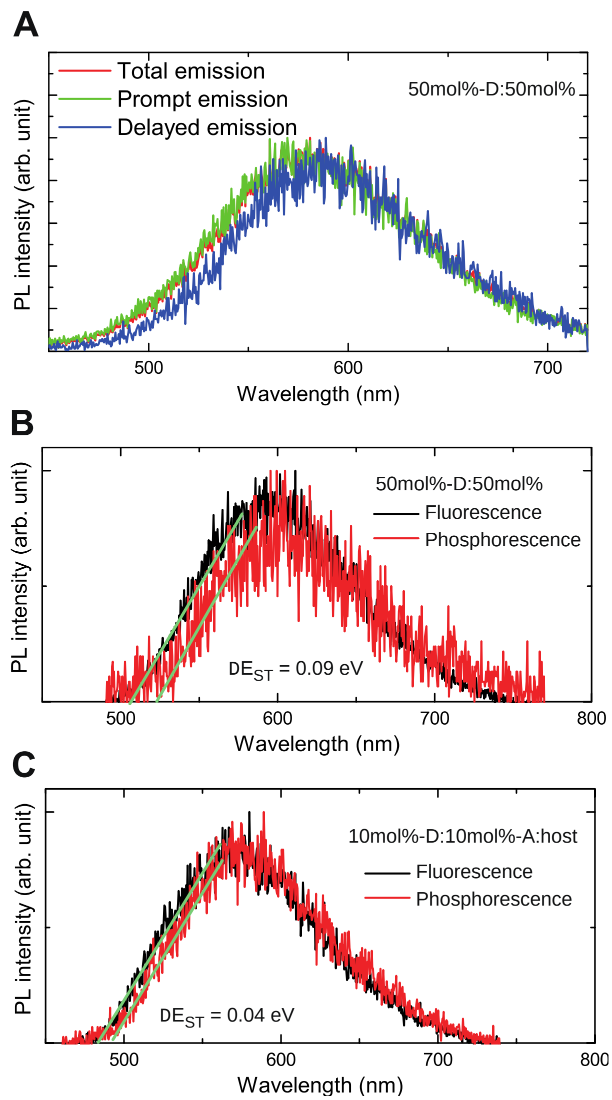

Figure S2: (a) Time-resolved PL spectra of a 50 mol% donor (D):50 mol% acceptor (A) co-deposited film at room temperature. Accumulated emission spectra for total (red), prompt (green) and delayed (blue) components of a D:A co-deposited film. Time-resolved PL spectra of (b) 50 mol% D:50 mol% A and (c) 10 mol% D:10 mol% A:80 mol% mCBP co-deposited films at 5 K. The black and red lines are fluorescence and phosphorescence spectra of these co-deposited films, respectively. The green lines indicate the onset of each emission. The phosphorescent spectrum was collected from 0.1 to 5 ms after excitation, where TADF intensity is negligibly small. Because the long-lived delayed component appears at only low temperature (5 K), we assigned the long-lived delayed component to phosphorescence.

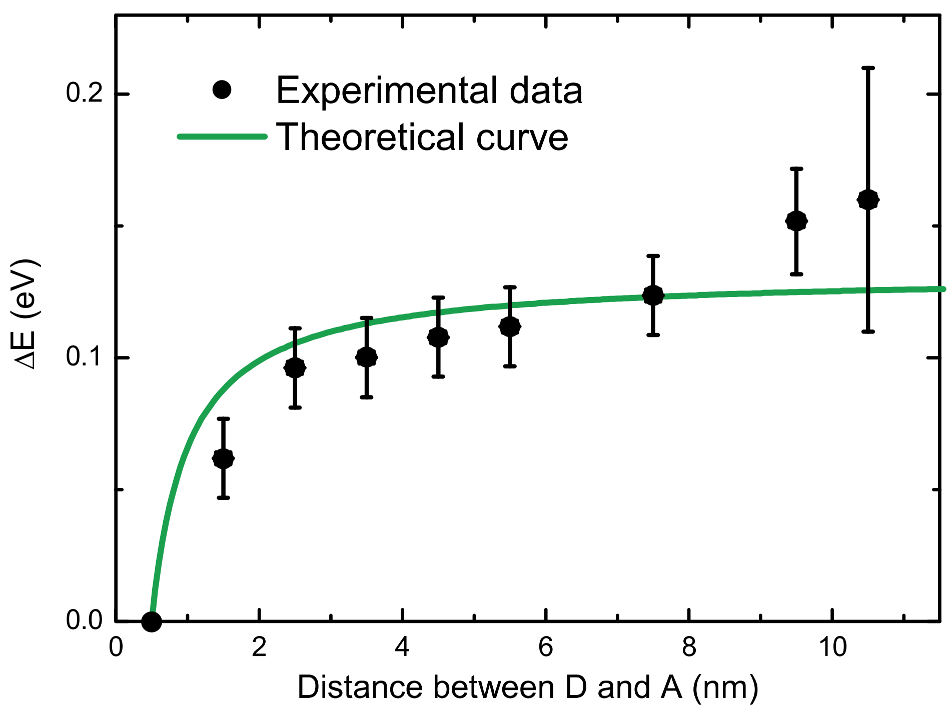

Figure S3: Exciton energy was calculated from the maximum electroluminescence emission peak. We set the initial distance between D and A (*i.e.*, spacing layer thickness d = 0 Å) as 5 Å. The solid line indicates the theoretical curve for the energy difference between the exciton energy at r ($I_D - A_A - E_{C\_r}$) and the exciton energy under initial conditions ($I_D - A_A - E_{C\_r=5}$).

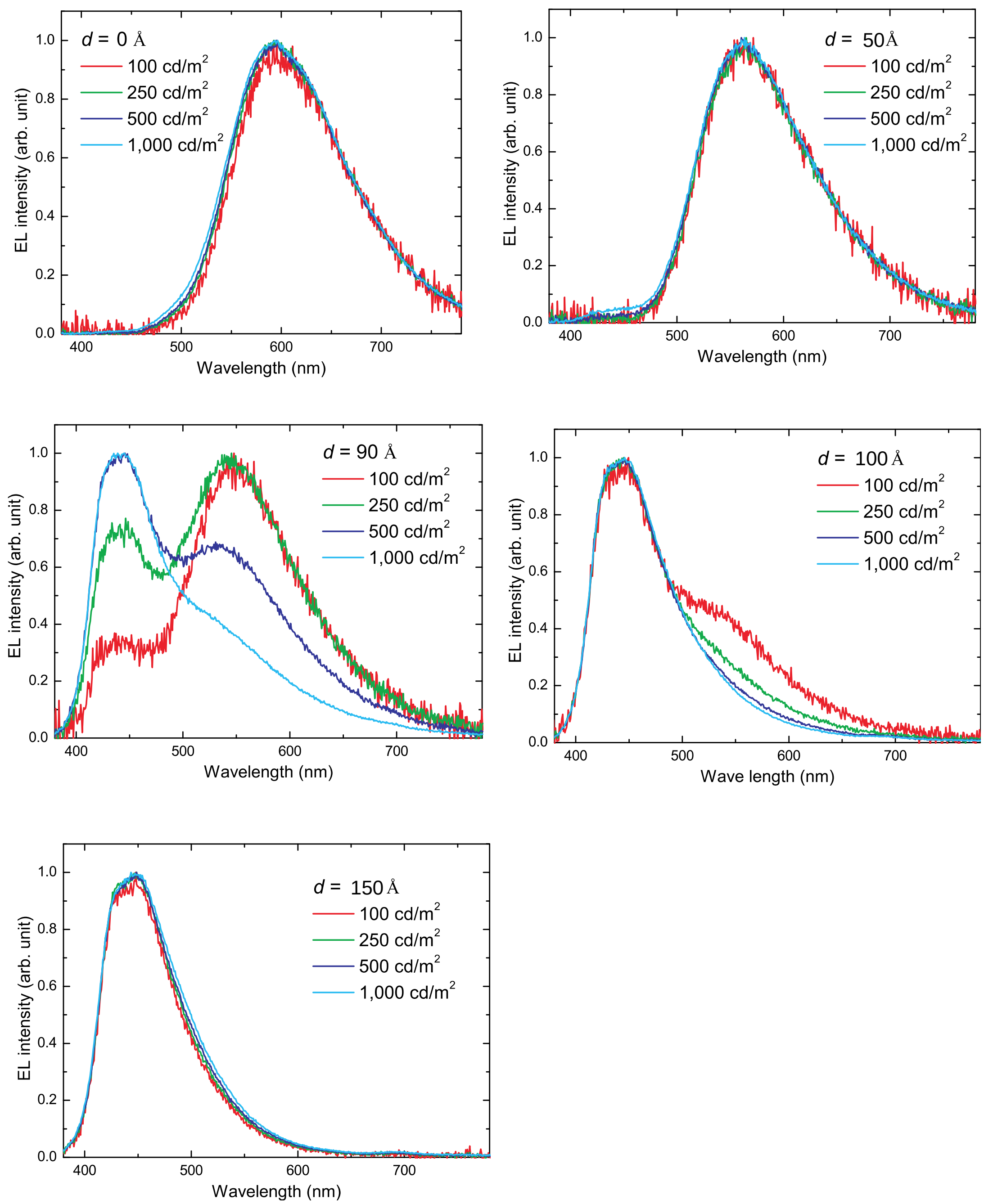

Figure S4: Dependence of EL spectra on luminance for devices with spacing layer thickness *d* = 0, 50, 90, 100, 150 Å.

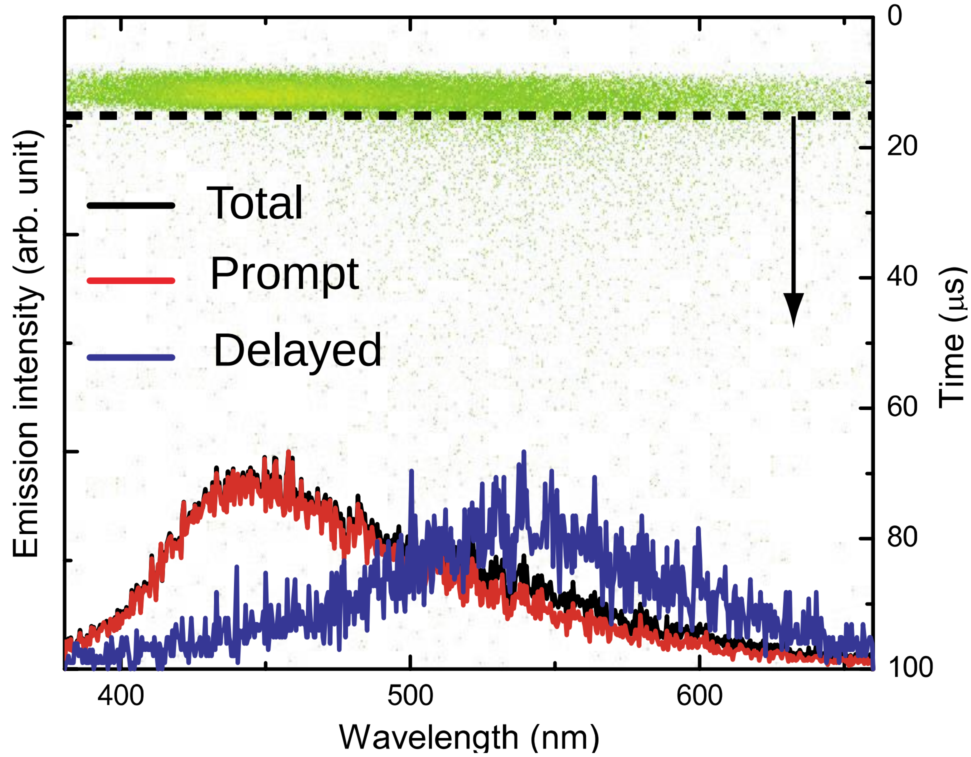

Figure S5: Time-resolved electroluminescence (EL) image for a device with spacing layer thickness d = 100 Å at room temperature. The delayed EL spectrum was collected from 5 to 100 μs after excitation.

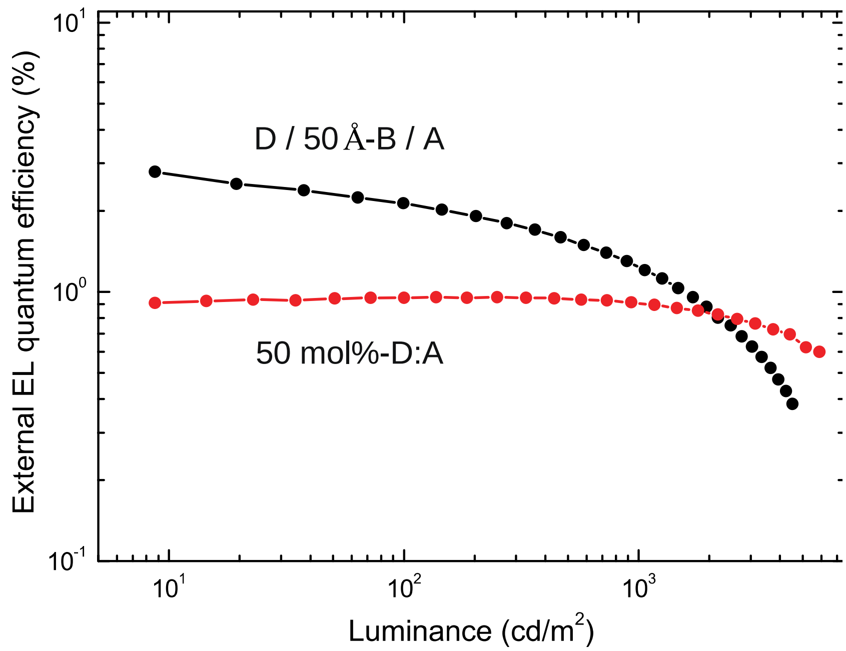

Figure S6: External electroluminescence (EL) quantum efficiency as a function of luminance for a device with spacing layer thickness d = 50 Å (black) and for a device with a 50 mol% D:A co-deposited film as an emissive layer (red).

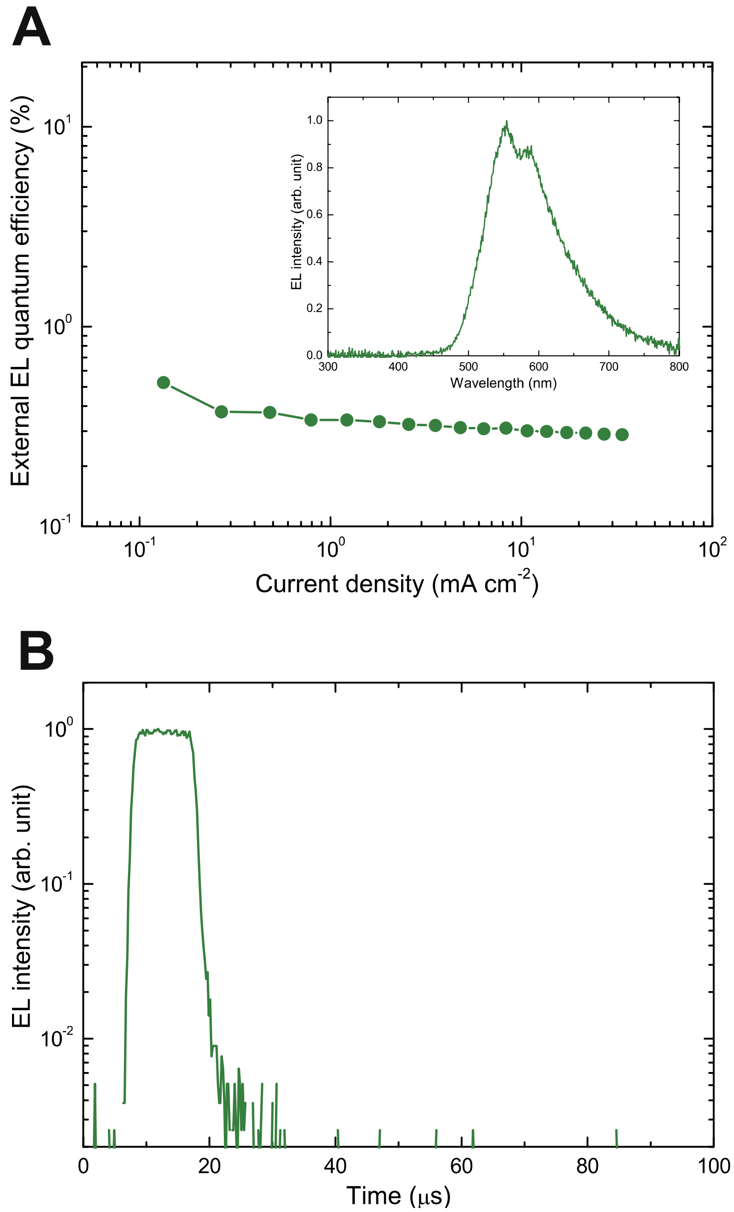

Figure S7: (a) External electroluminescence (EL) quantum efficiency as a function of injected current density for a device with a 50-Å-thick ADN spacer layer. (b) Time-resolved EL decay curves measured for the device with a 50-Å-thick ADN spacer layer at room temperature. EL accumulated after exposure of each OLED to a pulse voltage with a duration of 10 μs.