Abstract Submitted
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Probing the exciton coherent size in organic crystals and the effect of polar bonds[1] WAI-LUN CHAN, TI WANG, Univ of Kansas — Exciton transport in organic crystals is commonly described by a series of incoherent hopping. This is no longer valid if the transport range is on the order of the exciton coherent size. Recently, it has been proposed that exciton delocalization is responsible for ultrafast charge separation found in bulk heterojunction (BHJ) photovoltaics. However, the coherent exciton transport range has not been measured. Here, by using time-resolved photoemission and zinc phthalocyanine crystals as a model system, we observe a transition from coherent to incoherent transport while the exciton coherent size is decreasing. The electron-vibration interaction is found to be the main driving force that reduces the exciton coherent size. Furthermore, by using phthalocyanine molecules with a polar bond, e.g. titanyl phthalocyanine, we observe an upshift in electron energy as a function of time after photo-excitation. Our observation can be explained by spontaneous exciton dissociation after photoexcitation, which produces a more delocalized charge transfer state. This would explain why BHJ made by 'push-pull' polymers or small molecules, which consist of electron-rich and electron- deficient units, often have a better charge separation efficiency.

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Wai-Lun Chan
Univ of Kansas

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