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Discovery of bound excitons in twisted bilayer graphene HIRAL PATEL, Department of Physics, Oregon State University, JIWOONG PARK, Department of Chemistry, Cornell University, MATT GRAHAM, Department of Physics, Oregon State University — Recent first principle Bethe-Salpeter simulations of twisted bilayer graphene (tBLG), predict that the unique geometry of tBLG's overlapping interlayer 2p orbitals produce a strong destructive coherence effect that results in stable, strongly bound exciton states. We directly probe the electronic dynamics of twisted bilayer graphene for the first time by developing a unique ultrafast confocal microscopy approach that combines transient absorption, and transmission electron microscopy. We find resonantly excited twisted bilayer regions display distinct, long-lived dynamics that are not present in 0^o stacked bilayers. We further map out the electronic structure using one and two-photon transient absorption microscopy to observe signatures of both unbound and strongly bound excitonic states predicted by the theory. The probable existence of the stable excitons opens up the possibility of efficient carrier extraction by exploiting the unusual hybrid metallic-excitonic nature in twisted bilayer graphene systems.

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