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**Persistent mobility edges and anomalous quantum diffusion in order-disorder separated quantum films**[1] JIANXIN ZHONG, G. MALCOLM STOCKS, Oak Ridge National Laboratory — A novel concept of order-disorder separated quantum films is proposed for the design of ultra-thin quantum films of a few atomic layers thick with unconventional transport properties. The concept is demonstrated through studying an atomic bilayer comprised of an ordered layer and a disordered layer. Without the disordered layer or the ordered layer, the system is a conducting two-dimensional (2D) crystal or an insulating disordered 2D electron system. Without the order-disorder phase separation, a disordered bilayer is insulating under large disorder. In an order-disorder separated atomic bilayer, however, we show that the system behaves remarkably different from the conventional ordered or disordered electron systems, exhibiting metal-insulator transitions with persistent mobility edges and super-diffusive anomalous quantum diffusion. Application of the model to double-layer graphene systems will be discussed.

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