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Controlling and enhancing high frequency collective electron dynamics in superlattices by chaos-assisted miniband transport MARK FROMHOLD, MARK GREENAWAY, NATALIA ALEXEEVA, University of Nottingham, ALEXANDER BALANOV, Loughborough University, OLEG MAKAROVSKY, AMALIA PATANE, University of Nottingham, MARAT GAI-FULLIN, FEO KUSMARTSEV, Loughborough University — We show in both measurements and calculations that a tilted magnetic field can transform the structure and THz dynamics of charge domains in a biased semiconductor superlattice (SL) [1]. In SLs, at critical field values, when the Bloch frequency equals the cyclotron frequency corresponding to the magnetic field component along the SL axis, the semiclassical electron motion changes abruptly from localized stable trajectories to unbounded chaotic paths, which propagate rapidly through the SL. This delocalisation of the electron creates a series of sharp resonant peaks in drift velocity-field characteristics, which were detected in previous DC current-voltage measurements. We show that these additional peaks can create multiple propagating charge domains, shaped by both the strength and tilt angle of the magnetic field. As a result, the tilted magnetic field generates AC currents whose magnitude and frequencies are far higher than with no magnetic field applied. Chaos-assisted single-electron transport induced by the interplay between cyclotron and Bloch motion therefore provides a mechanism for controlling the collective dynamics of miniband electrons, and thus enhancing the high frequency response of SLs. References: [1] N. Alexeeva et. al. Phys. Rev. Lett. 109, 024102 (2012)

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