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Observation of a devil's staircase behavior and experimental control of chaos in wave-particle interaction ALESSANDRO MACOR, FABRICE DOVEIL, YVES ELSKENS, Lavoratoire De Physique des interaction ioniques et moleculaire CNRS-Univeriste' de Provence — A specially designed Traveling Wave Tube allows to carefully study wave-particle interaction; in the case when the beam electrons can be considered as test particles a devil's staircase has been observed by recording the beam velocity distribution function vs the amplitude of two induced waves. Its existence was related to the transition to large scale chaos in such a system, paradigm of two degrees of freedom systems in Hamiltonian dynamics[1]. Chaos often represents an obstacle for the control of experiments; we showed the robustness of a control method for Hamiltonian chaos by varying methodically the pertinent parameters of system[2]. Increasing the beam intensity self-consistent phenomena gradually enter; commonly leading to wave growth and further nonlinear saturation. A generator able to produce subnanosecond electron pulses at high repetition rate was installed allowing to explore the influence of the relative phase of electron packets with respect to waves[3]. **1** A. Macor, F.Doveil and Y.Elskens, Phys. Rev. Lett. **95**, 264102 (2005) and Chaos **16**, 1 (2006) **2** C.Chandre et al., Phys. Rev. Lett. **94**, 074101 (2005) **3** A.Macor, F.Doveil and E.Garabedian, J-NPCS (in press)

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