Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Determination of the coherence length in the Integer Quantum Hall Regime. F. PORTIER, P. ROULLEAU, P. ROCHE, CEA Saclay , SPEC, Nanoelectronic group, F-91191 Gif-sur-Yvette, A. CAVANNA, G. FAINI, U. GENNSER, D. MAILLY, CNRS, LPN, Phynano team, Route de Nozay, F-91460 Marcoussis, NANOELECTRONIC GROUP COLLABORATION, PHYNANO TEAM COLLABORATION — 0ne of the basic length scales limiting quantum effects in electrical conductors is the phase coherence length L_φ, the typical length on which an excitation looses its phase coherence via coupling to other degrees of freedom. In quasi-1D diffusive wires, due to electron-electron interactions, L_φ was shown to scale as $T^{-1/3}$, as predicted by Altshuler-Aronov-Khmelnitsky. Surprisingly, little is known about L_φ in the Integer Quantum Hall Regime (IQHE), where transport occurs through 1D chiral wires, localized on the edges of the sample. The number of these 'edge states' is equal to the filling factor (the number of electron per flux quantum flux). Chirality should prevent momentum conserving energy exchange processes, leading to a very long coherence length.We present an experiment where we have determined L_φ in the IQHE at filling factor 2, by measuring the visibility of quantum interferences in an electronic Mach-Zhender interferometer. L_φ shows a T^{-1} dependence, proved to result from the coupling between the two neighbouring edge states: the thermal charge noise in one edge state blur the phase on the other edge state, leading to a finite coherence length proportional to T^{-1}. .

F. Portier
CEA Saclay , SPEC, Nanoelectronic group, F-91191 Gif-sur-Yvette

Date submitted: 21 Nov 2008 Electronic form version 1.4