1099-46-215 **Yoann N. Dabrowski*** (`dabrowski@math.univ-lyon1.fr`), 69005 Lyon, France. *Higher order regularity of conjugate variables along free brownian motions.* Preliminary report.

Voiculescu's non-microstates free entropy is based on the computation of conjugate variables ξ_t (the free analogue of score function) along a free brownian motion starting at a rather general vector of self-adjoint non-commutative random variables. Voiculescu proved the first regularity property, namely $\xi_t, t > 0$ is in $L^\infty(M, \tau)$. The author proved last year using time reversals of free diffusions that ξ_t is in the domain of the free difference quotient ∂ as an operator in L^2 for almost every t.

After reviewing this background, we will explain how the use of continuous time martingale techniques coming from [Junge,Perrin] (arXiv:1301.2071) enables to prove $\partial\xi_t$ are in various L^p-modules. Using also Haagerup tensor product techniques, one can get regularity of higher order free difference quotients of ξ_t.

This search for more regularity is motivated by obtaining a strong solution for the time reversal of free brownian motion where ξ_t appears as a drift. This strong solution property is true in the classical case by Veretennikov's result improved recently by Krylov, Priola etc and is important for free entropy applications. (Received February 09, 2014)