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Free Liberation of Projections.

Free liberation is a flow on pairs of operators, taking them toward freeness. It was introduced by Voiculescu in 1999 to be used in the analysis of free entropy and free Fisher information. It uses the free unitary Brownian motion to conjugate one operator so that, as time tends to infinity, a Haar unitary appears to produce freeness.

Let p and q be two projections, and let (p_t, q_t) be their free liberation. We use the free SDE for free unitary Brownian motion to construct a non-linear PDE that describes the flow of the law of $p_t q_t$, essentially characterizing the “principle angles” between the subspaces spanned by p_t and q_t . The arcsin law is a global attractor for this evolution, as expected.

We show that this PDE behaves like a non-linear heat flow, having conservation and smoothing properties. In the special case that p and q have trace $1/2$, the PDE miraculously can be converted into a functional equation, introducing a new kind of subordination. This allows for very fine analysis of its local and global evolution. (Received August 09, 2010)