« Théories de jauge, monopoles, espaces de modules et systèmes intégrables » Une conférence en l'honneur de Jacques Hurtubise, à l'occasion de son 60<sup>e</sup> anniversaire 21 au 25 août 2017

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## The Noncommutative Geometry of Difference Equations

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One can view the theory of *D*-modules (on curves) as a noncommutative analogue of the theory of sheaves on the cotangent bundle, extending the usual relaxation of connections on vector bundles to Higgs bundles. It turns out that (after a suitable compactification) this extends considerably: any rationally ruled projective surface admits a natural family of noncommutative deformations equipped with interpretations of certain sheaves as (discrete) connections (e.g., elliptic difference equations, the Higgs-ish relaxation of which was studied by Hurtubise and Markman). I'll discuss a number of aspects of this construction, with particular attention to structural properties of the moduli spaces (projectivity, Poisson structures), associated nonautomous integrable systems, and certain derived actions of  $SL_2(Z)$  on deformations of elliptic surfaces.

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