Originally prepared as a contribution to memorial publication in honor of H Pierr Noyes for his 90-th birthday [1], this article reviews author's previous works on uses of discretized variables and non-commutative geometry in physics, in a revised and updated form to include recent results (*e.g.*, [2]) in the same topic. Applications of non-commutative geometry to physics are conventionally implemented by star-products, symbols and non-commutative algebra which we express in terms of non-commutative parameters. The commutative limits are then realized by taking certain limits of the non-commutative parameters. Algebraically, the transition from commutative to non-commutative descriptions are analogous to the transition from classical to quantum pictures in terms of the Poisson brackets of (classical) functions and the commutator of (quantum) operators, respectively.

The author uses a slightly different approach on such a transition by introducing a notion of discreteness and constructing discrete calculus on the non-commutative geometry. The author derives constraints that connect the discrete calculus and the ordinary classical calculus, further discussing that such constraints can be related to the formulation of non-commutative electromagnetism and to a so-called Kilmister equation in general relativity. Details on these studies are presented in the latter half of this article.

References

[1] Louis H. Kauffman, "Non-Commutative Worlds and Classical Constraints," doi:10.1142/9789814579377_0011, Scientific Essays in Honor of H Pierre Noyes on the Occasion of His 90th Birthday, pp. 169-201 (2014) [https://doi.org/10.1142/9789814579377_0011], arXiv:1109.1085 [math-ph].

[2] A. M. Deakin and L. H. Kauffman, "Cosmological Theories of the Extra Terms," arXiv:1801.06788 [gr-qc].