ID de Contribution: **3**   Type: **Non spécifié**

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lundi 3 juin 2024 11:40 (30 minutes)

Exploring the Limits: Unbounded Diophantine Approx- imations and Matrix Transformations

In this talk, I will present our recent advancements on the shrinking target
problem of matrix transformation on tori and their subvarieties. For tori, we can provide sharp asymptotic results in a remarkably broad setting. This research has been naturally linked with expansion of the Mass Transference Principle to unbounded conditions, a tool which holds an independent interest on its own. I will present the progress in this direction as well.
In a much more refined case of subvarieties of tori, our findings are (yet) less sharp. So far, we have established the Khintchine theorem for curves in a two-dimensional torus and a Jarník-type theorem for straight lines (the latter result is conditional under abc-conjecture for high exponents of approximations). The latter topic clearly leads to a very interesting, rich and fascinating theory. Joint project with W. Baowei, B. Li, L. Liao, and S. Velani.