Integrability from Line Defects in M-theory

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Abstract

Integrability is a quite powerful tool to reveal nonperturbative aspects of QFTs. In general, integrability implies there should exist a beautiful physical or mathematical structure behind the system. In this talk, I will show that line defects such as the Wilson lines and the 't Hooft lines play a crutial role to realize integrability in class $\mathcal{S}$ theories. For class $\mathcal{S}$ theories equipped with line defects, the brane tilings give us a clear picture of the integrability in both mathematical and physical sense. We focus on the 't Hooft loops in $\mathcal{N} = 2$ supersymmetric QFTs on $S^1 \times \mathbf{R}^3$ studied in [1, 2], and we find that the loop operators are naturally identified with a difference operator in an integrable lattice model which is the dual system given by the brane tilings. Our results will provide new perspectives on the origin of integrability in supersymmetric QFTs. This talk is based on the joint work with Kazunobu Maruyoshi and Junya Yagi [3].

References

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[2] H. Hayashi, T. Okuda and Y. Yoshida, "Wall-crossing and operator ordering for 't Hooft operators in $N = 2$ gauge theories," arXiv:1905.11305 [hep-th].

[3] K. Maruyoshi, T. Ota and J. Yagi, "Integrability from Line Defects in M-theory," to appear.