Non-Hermitian geometry and topology induce non-trivial photonic dynamics

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The geometry of quantum states provides a solid framework for explaining complex phenomena that conventional approaches fail to address. Despite its success in Hermitian systems, quantum geometry remains far less understood in non-Hermitian systems.

In this presentation, I want to show new interesting effects that we predicted and observed experimentally recently using Rubidium vapor cells. First, we study a photonic quasicrystal and demonstrate that combined with non-Hermiticity, it leads to the delocalisation of the wave packet [PRL 132, 263801 (2024)]. This is rather counter-intuitive as both effects (quasicrystal and non-Hermiticity) usually lead to localisation.

Then, I will show our latest work where a photonic crystal hosting a ring of exceptional points leads to an anomalous non-Hermitian drift, analogous to but different from the anomalous Hall drift of Hermitian systems [arXiv:2410.14428]. To describe this effect, the standard quantum metric is not an adapted tool. Instead, the biorthogonal quantum metric must be used, which proves the utility of this approach.

Our works represent cutting-edge developments in the field of topological photonics in the broad sense and show how non-Hermiticity can lead to new effects with potential applications in beam steering.

References

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