# Non-Hermitian physics without gain or loss: the skin effect of reflected waves

**Viktor Könye**
Selma Franca, Fabian Hassler, Jeroen van den Brink, and Cosma Fulga

*University of Amsterdam, Amsterdam, Netherlands*

v.konye@uva.nl

Physically, one tends to think of non-Hermitian systems in terms of gain and loss: the decay or amplification of a mode is given by the imaginary part of its energy. Here, we introduce an alternative avenue to the realm of non-Hermitian physics [1], which involves neither gain nor loss. Instead, complex eigenvalues emerge from the amplitudes and phase-differences of waves backscattered from the boundary of insulators. We show that for any strong topological insulator in a Wigner-Dyson class, the reflected waves are characterized by a reflection matrix exhibiting the non-Hermitian skin effect. This leads to an unconventional Goos-Hanchen effect: due to non-Hermitian topology, waves undergo a lateral shift upon reflection, even at normal incidence (Fig. 1). Going beyond systems with gain and loss vastly expands the set of experimental platforms that can access non-Hermitian physics and show signatures associated to non-Hermitian topology [2][3].

## References

[1] Selma Franca, Viktor Könye, Fabian Hassler, Jeroen van den Brink, and Cosma Fulga, Phys. Rev. Lett. 129, 086601, (2022)

[2] Ochkan, K., Chaturvedi, R., Könye, V. *et al.* Non-Hermitian topology in a multi-terminal quantum Hall device. *Nat. Phys.* (2024)

[3] Viktor Könye, Kyrylo Ochkan, Anastasiia Chyzhykova, Jan Carl Budich, Jeroen van den Brink, Ion Cosma Fulga, Joseph Dufouleur, arXiv:2308.11367 (2023)

## Figures

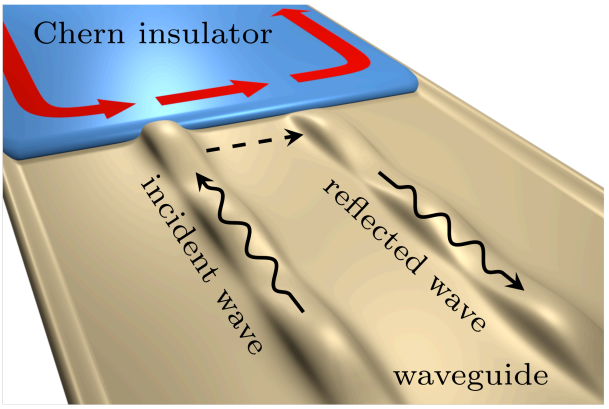


**Figure 1:** Schematic figure for the non-reciprocal Goos-Hanchen effect