A nonreciprocal Weyl semimetal waveguide

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Abstract: I will present analytical results about the surface plasmon modes of a cylindrical waveguide, constituted by a topological Weyl semimetal in a dielectric cladding, highlighting the role of the angular momentum quantum number.

Weyl semimetals are intensely investigated topological materials, in which valence and conduction bands touch in a finite number of points [1]. They possess nontrivial transport properties, which can be traced back to the presence of an axionic term in the emergent electrodynamics [2,3]. In this talk, I will address a cylindrical plasmonic waveguide consisting of a magnetic Weyl semimetal embedded in a dielectric medium. I will present the main features of the dispersion relation of surface plasmons and show its dependence on the cylinder radius and the position of the band-touching points [4].

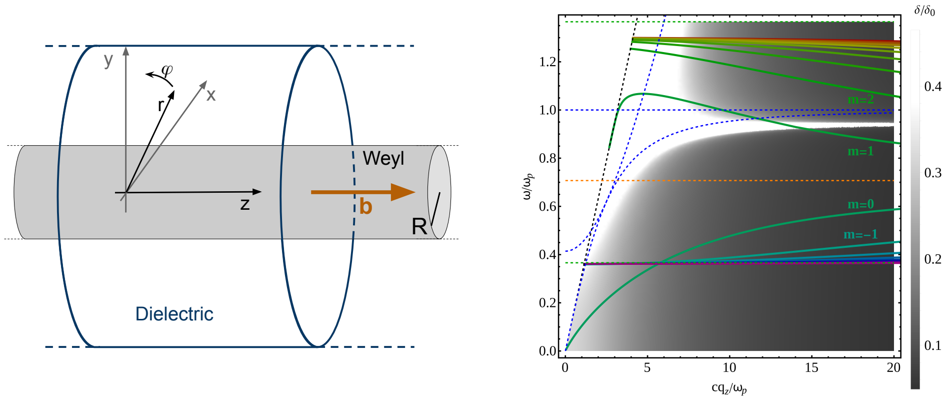

Fig. 1 Left: scheme of the waveguide. Right: example of surface plasmon dispersion relations, for various values of the orbital angular momentum; the background depicts the penetration length.

In contrast to metallic waveguides, the axionic term determines an asymmetry of the surface plasmon dispersion, see Fig. 1, and a giant splitting of the plasmon velocity in bands of opposite orbital angular momentum, with potential technological applications.

References

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