Geometric Phase-Driven Scattering Evolutions

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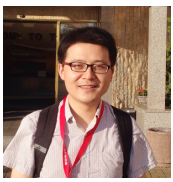
We explore the classical topic of scattering manipulation, from a different perspective of controlled excitations and interferences of quasi-normal modes (QNMs). Scattered waves can be expanded as coherent additions of radiations from the QNMs excited, and thus relative amplitudes and phases among them are crucial factors to engineer for scattering shaping. Here relying on the electromagnetic reciprocity, we provide full geometric representations based on the Poincarй sphere for those factors, and identify the hidden underlying geometric phases that drive the scattering evolutions. Further synchronous exploitations of the incident polarization-dependent geometric phases and excitation amplitudes enable efficient manipulations of both scattering intensities and polarizations. Continuous geometric phase spanning 2π is directly manifest through scattering variations, even in the rather elementary configuration of an individual particle scattering waves of varying polarizations. We have essentially merged three vibrant fields of geometric phase, Mie scattering and QNM, and unlocked an extra geometric phase dimension for scattering manipulations, which will greatly broaden horizons of many disciplines not only in photonics but also in general wave physics where geometric phase is generic and ubiquitous.



Short Bio:

Wei Liu received his BSc and PhD degrees respectively from Peking University and Australian National University. He works
mainly on Mie theory, and explore its hidden geometric, topological and singular structures.