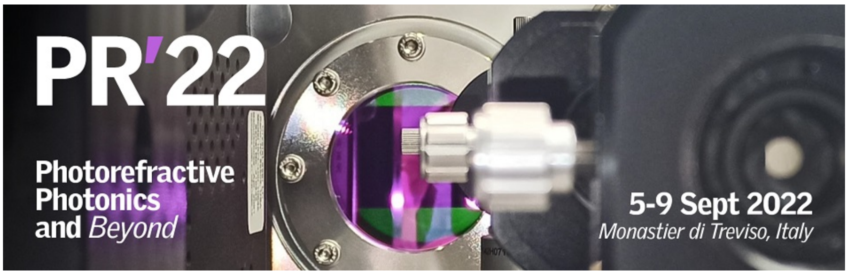

Contribution ID: **34**

Type: **Invited Talk**

Synthetic Magnetism in Nonlinear Photonic Crystals

Thursday, 8 September 2022 14:50 (35 minutes)

The dynamics of nonlinear sum frequency generation is analogous to spin current dynamics in magnetic fields: the signal and idler complex amplitudes represent the two-dimensional spinor; the nonlinear coupling (governed by the undepleted pump and nonlinear modulation) represents the strength and direction of the magnetization; and the transverse Laplacian of the beams represent the kinetic energy. This analogy can be useful for broadband frequency conversion, for accumulation of geometric phase and its application for non-reciprocal and asymmetric beam focusing and for spin-dependent deflection, representing the nonlinear-optics analogue of the Stern-Gerlach effect. The recent breakthrough that enables now to modulate the nonlinear coefficient in all the three dimensions of the nonlinear crystal opens the door for the design and formation of skyrmionic nonlinear photonics crystals. These structures would give rise to an all-optical topological Hall effect, in which the deflection of light beams depends on the spectrum and propagation direction of the input light. Furthermore, this deflection can be optically controlled by the topological charge of the pump beam. Whereas these effects are observed with classical light beams, when a signal-idler frequency-superposition qubit is injected, new effects such as bunching of the two-photon state are revealed, thereby enabling new possibilities to control the spectral and spatial degrees of freedom of quantum light.

Primary author: ARIE, Ady (Tel Aviv University)

Presenter: ARIE, Ady (Tel Aviv University)

Session Classification: Optical analogues of complex phenomena

Track Classification: Optical analogues of complex phenomena: quantum systems, general relativity, chaos