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Slow photons as charged quasi-particles, and photonic Aharonov-Bohm effect[1] KARL-PETER MARZLIN, JUERGEN APPEL, ALEXANDER LVOVSKY, IQIS, University of Calgary — Recently we have proposed the method of Raman Adiabatic Transfer of Optical States (RATOS) to manipulate the optical state of light. A four-level atomic medium in double-Λ configuration is interacting with two pump fields and a signal photon with very slow group velocity. An adiabatic change in time of the pump fields can then generate a slow photon in a superposition of different frequencies. Here we theoretically analyze the influence of an adiabatic change in the spatial form of the pump fields. We demonstrate that the signal photon then behaves like a charged quasi-particle: in paraxial approximation its dynamics is governed by a Schrödinger-like equation that includes a scalar and a vector potential whose form is determined by the shape of the pump fields. We suggest pump field configurations that generate potentials corresponding to a constant electric and a constant magnetic field. Furthermore we devise a scheme of pump fields that generates a vector potential of Aharonov-Bohm type which induces a topological phase shift for slow photons.

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