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Measuring the Geometric Phase of the Driven Harmonic Oscillator STEFFEN WEIMANN, ARMANDO PEREZ-LEIJA, ALEXANDER SZAMEIT, Institut für Angewandte Physik, Freidrich-Schiller Universität Jena — Since Aharonov and Anandan discovered that, in general, quantum states acquire a geometric phases during evolution, regardless of whether the associated Hamiltonian evolves adiabatically or not; geometric phases have become present in the formulation of most fundamental physical statements. Here, we propose a system allowing direct observation of the geometric phase, arising after cyclic evolution, in one of the most fundamental physical systems, the driven quantum harmonic oscillator (DQHO). In our work we calculate the geometric phase for a general time-dependent DQHO and propose a scheme to measure it. The DQHO Hamiltonian can be realized using engineered arrays of coupled optical waveguides. In such an array the electric field amplitude exhibits the same dynamics as the wave function of a DQHO in the Fock base representation. Moreover, we show that the dynamic phase acquired by the electric field representing the oscillator state and the field traversing an isolated waveguide are the same. Hence, by superimposing both fields at the revival point, the emergent interference pattern will be governed only by the associated geometric phase. On this platform we can easily establish the exact dependence of the geometric phase on the parameters of the DQHO.

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