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Synthetic anyons in noninteracting systems[1] FRANE LUNIC, MARIJA TODORIC, Department of Physics, Faculty of Science, University of Zagreb, TENA DUBCEK, Institute for Theoretical Physics, ETH Zrich, DARIO JUKIC, Faculty of Civil Engineering, University of Zagreb, HRVOJE BULJAN, Department of Physics, Faculty of Science, University of Zagreb — We demonstrate that anyons, particles with exotic exchange statistics, can in principle be synthesised by perturbing 2D noninteracting many-body systems with specially tailored localized probes. This approach stands in contrast to the fractional quasiparticle excitations of strongly correlated interacting systems observed in experiments thus far. We consider the case of noninteracting 2D electron gas in a uniform magnetic field (IQHE) perturbed with external solenoids carrying a magnetic flux that is a fraction of the flux quantum. This results in charge-flux composites that can be considered Wilczek's anyons. The flux-dependent fractional statistics of the wave function in the coordinates of the solenoids is demonstrated analytically and numerically by determining the statistical contribution to the Berry phase accumulated as a solenoid traverses a closed path around another solenoid. This result holds if a small amount of disorder is introduced into the system. We discuss possible platforms and probes for experimental realization of this idea, including noninteracting fermions in a 2D periodic potential, ultra-cold atoms, and magnetic needles suspended above a 2D electron gas heterostructure grown on a material of high magnetic permeability.

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