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Vortex-antivortex phenomena in superconductors with antidot arrays GOLIBJON BERDIYOROV, MILORAD MILOSEVIC[1], ROELAND GEURTS, FRANCOIS PEETERS, Departement Fysica, Universiteit Antwerpen (CGB), Belgium — We investigated in detail the vortex configurations in superconducting films with regular antidot-arrays within the non-linear Ginzburg-Landau theory, where demagnetization effects and overlapping vortex cores are fully taken into account (contrary to the London approach). In addition to the well-known matching phenomena, we predict: (i) the *nucleation of giant-vortex states* at interstitial sites; (ii) the *combination of giant- and multi-vortices* at rational matching fields; and (iii) for particular interstitial vorticity, the symmetry imposed creation of *vortex-antivortex configurations*. As a consequence of (iii), we predict *resistance maxima* at particular matching fields, opposite to the expected minima due to commensurability effects. Using the same principle, we stabilized vortex-antivortex molecules in finite submicron superconducting polygons by strategically placed nanoholes. Compared to earlier predictions, we *enhanced* the stamina of the antivortex with respect to temperature, applied fields and geometrical defects in the sample. Further, increased vortex-antivortex spacing and pronounced amplitudes of the local magnetic field in our system make these fascinating structures *observable* by e.g. Scanning Tunneling or Hall probe microscopy.

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