**Superconductivity in Epitaxial Gallium-doped Germanium**

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Introducing superconductivity into group IV elements by doping has long promised a pathway to introduce quantum functionalities into well-established semiconductor technologies. Recent progress with non-equilibrium hyperdoping has shown superconductivity in C, Si, and Ge, but the role of disorder and dopant clustering has obscured the origin of this effect. I will present our work on epitaxial growth of gallium-hyperdoped germanium films and trilayer heterostructures by molecular beam epitaxy. These films reach extreme hole concentrations, via nearly 18% Ga substitution, and display superconductivity with a transition temperature of 3.5 K. Using synchrotron X-ray absorption and scattering, we find that Ga atoms incorporate substitutionally in the Ge lattice, introducing a slight tetragonal distortion. First-principles calculations support these findings and point to the formation of a narrow band that enables superconductivity. Together, these results establish hyperdoped Ga:Ge as a structurally ordered superconductor–semiconductor platform suitable for quantum technologies.

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