Superconductivity is a fascinating state of matter in which an electrical current can flow without any resistance. Usually, it can exist in two forms. One is destroyed easily with a magnetic field and has "even parity" (i.e., it has a point symmetric wave function with respect to an inversion point). The other form is stable in magnetic fields applied in certain directions and has "odd parity" (i.e., it has an antisymmetric wave function). Consequently, the latter form should present a characteristic angle dependence of the critical field where superconductivity disappears. But odd-parity superconductivity is rare in nature; only a few materials support this state, and in none of them has the expected angle dependence been observed.

In a new publication in Physical Review X, the group by Elena Hassinger and collaborators show that the angle dependence in the superconductor CeRh$_2$As$_2$ is exactly that expected of an odd-parity state.

CeRh$_2$As$_2$ presents an extraordinary opportunity to investigate odd-parity superconductivity further. It also allows for testing mechanisms for a transition between two superconducting states, and especially their relation to spin-orbit coupling, multiband physics, and additional ordered states occurring in this material.


Provided by Max Planck Society