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Switching the d-wave gap in layered perovskite iridates via spin reorientation

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We demonstrate switching of the *d*-wave charge gap in electron-doped $Sr_3Ir_2O_7$ through changing the spin easy axis. The pristine, undoped $Sr_3Ir_2O_7$ has *c*-axis collinear antiferromagnetic structure with strong Ising anisotripy, which gaps out magnons with an unprecedentedly large energy scale of 90 meV. However, a metastable phase with *ab* easy-plane anisotropy is found in some surfaces of $Sr_3Ir_2O_7$, for which low-energy magnons are expected. Doping electrons to the latter leads to opening of a *d*-wave charge gap below ˜30 K, which is not found in the former. Our results indicate the magnetic origin of the *d*-wave gap in electron-doped layered perovskite iridates, and suggest a mechanism to control the charge gap via the spin degrees of freedom.