Isotope effect in superconducting n-doped SrTiO$_3$ ADRIEN STUCKY, GERNOT SCHEERER, ZHI REN, DIDIER JACCARD, JEAN-MARIE POUMIROL, CLINE BARRETEAU, ENRICO GIANNINI, DIRK VAN DER MAREL, University of Geneva, Department of Quantum Matter Physics, Geneva — Since the discovery of superconductivity in n-doped SrTiO$_3$ half a century ago, this material has played a key role in modern condensed matter physics, in part for its superconducting properties but also its dielectric properties and suitability as a substrate for thin film growth of high-$T_c$ superconductors. We report the influence on the superconducting critical temperature in doped SrTiO$_3$ of the substitution of the natural $^{16}$O atoms by the heavier isotope $^{18}$O. We have found a huge increase of the $T_c$ around 50% and an enhancement by a factor $\sim 2$ of the critical magnetic field $H_{c2}$ for all charge carrier densities. Such a strong impact on $T_c$ and $H_{c2}$, with a sign opposite to conventional superconductors, is unprecedented. Alternative models which take into account the presence of polarons in SrTiO$_3$ or the vicinity of a quantum critical point due to ferroelectric state are now considered and discussed to explain this behavior. Indeed, the unusually large size of the observed isotope effect supports a recent model for superconductivity in these materials based on strong coupling to the ferroelectric soft modes of SrTiO$_3$.