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Search for neutrinoless double beta decay of ^{128}Te with the CUORE experiment

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The CUORE experiment is a ton-scale array of TeO_2 cryogenic bolometers located at the underground Gran Sasso National Laboratories, in Italy. The CUORE detector consists of 988 crystals operated as source and detector at a base temperature of ~ 10 mK. The primary goal of CUORE is the search for neutrinoless double beta ($0\nu\beta\beta$) decay of ^{130}Te , but thanks to its large target mass and ultra-low background it is suitable for the study of other rare processes as well, one of these being the $0\nu\beta\beta$ decay of another tellurium isotope: the ^{128}Te . The ^{128}Te is an attractive candidate for the search of this process, due to its high natural isotopic abundance of 31.75%. The transition energy at $Q_{\beta\beta} = (866.6 \pm 0.9)$ keV lies in a highly populated region of the energy spectrum, dominated by the contribution of the $2\nu\beta\beta$ decay of ^{130}Te and the natural γ background due to environmental radioactivity. With its ton-scale mass, CUORE is able to achieve a factor >10 higher sensitivity to the $0\nu\beta\beta$ decay of this isotope with respect to past direct experiments.

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