SEARCH FOR DOUBLE β-DECAY OF ^{76}Ge TO EXCITED STATE OF ^{76}Se

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Lower limits on the half-lives of the 2β-decay $\{2\beta(0\nu + 2\nu)\}$ of ^{76}Ge to the excited states of ^{76}Se have been obtained, using the results of low-background measurements with a HPGe detector (116 cm^3) surrounded by 200 *kg* passive germanium shielding [1]. The search for these decays was carried out using a γ-spectrometer to look for gammas of the energies corresponding to the decays in germanium shielding.

The fig. shows the spectrum obtained in the energy range of 500—670 *keV* for 1004 h of the measurement. The energy resolution was 5 *keV* (FWHM) at 511 *keV*. The table gives all the limits and values of efficiency, that were calculated by M—C code for the level scheme for the decay of ^{76}Se, obtained in this work.

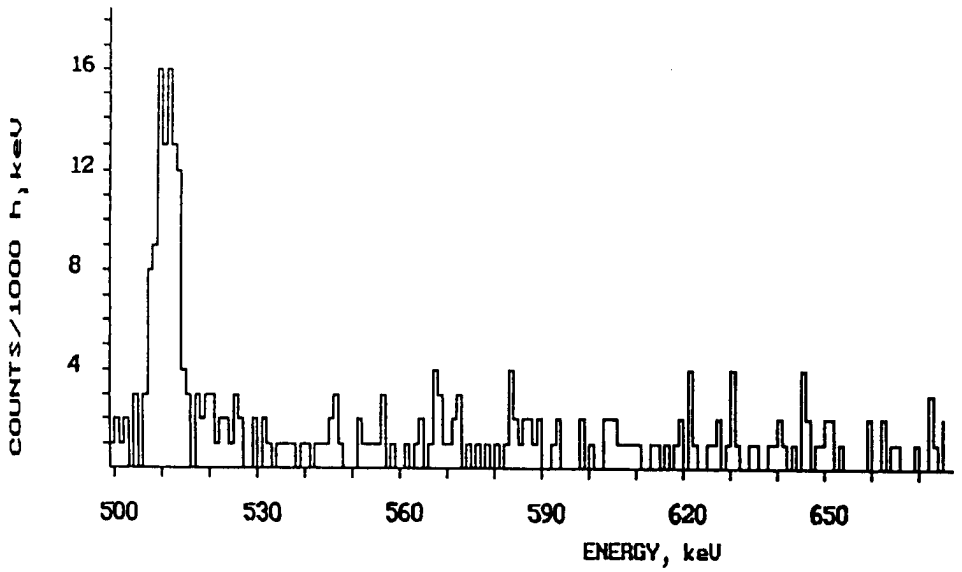

Fig. Background spectrum of HPGe detector, with volume of 116 cm^3, measured over 1004 h (summation at 1 *keV*/channel). Clearly visible is 511 *keV* peak.

The table also includes the limits obtained earlier. One can see that the limits for $2\beta(2\nu)$-decay are obtained by us for the first time for the similar transitions. In accordance with half-life of $2\beta\,2\nu$-decay ^{76}Ge to the ground state of ^{76}Se ($\tau_{1/2} = 10^{21}$ *y*) [5], the new experimental set-up which allows to work with the germanium detector assembly with a mass up to 20 *kg* inside the germanium shielding [6], has the sufficient sensitivity to detect the decays to the excited states.

Table

Limits on half-lives of ^{76}Ge for $2\beta(0\nu + 2\nu)$-decay to excited states of ^{76}Se and calculated efficiencies of detected γ-quanta

J_f^π	$E_{2\beta}$,*keV*	E_γ,*keV*	$\eta \cdot 10^3$	$T_{1/2}$, *y*		
				this work	earlier works	
				$2\beta(0\nu + 2\nu)$	$2\beta(2\nu)$	$2\beta(0\nu)$
2_1^+	1481.9	559.1	1.24	$>3.0\cdot10^{21}$(90%)	—	$>2.0\cdot10^{23}$ (68%) [2]
0_1^+	919.0	559.1	1.0	$>4.1\cdot10^{21}$ (90%)	—	$>2.0\cdot10^{22}$ (68%) [3]
		563.2	1.0			
2_2^+	825.0	559.1	0.66	$>3.3\cdot10^{21}$ (90%)	—	$>1.2\cdot10^{21}$ (90%) [4]
		657.0	0.60			
		1216.1	0.34			

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