β-γ Spectroscopy of ^{192}Re

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Decay spectroscopy of ^{192}Re has been carried out using the KEK Isotope Separation System (KISS).[1–3] A RI beam of ^{192}Re was produced via multi-nucleon transfer between a 50-particle-nA projectile of ^{136}Xe and a natural Pt target with a thickness of 10.7 mg/cm^2. The 10.75-MeV/nucleon primary beam from the RIKEN Ring Cyclotron was decelerated to 8.8 MeV/nucleon after passing through Ti degraders placed in front of the Pt target. The reaction products were thermalized and neutralized in a doughnut-shaped gas cell filled with 80-kPa gaseous argon, and then transported by a gas flow to the cell outlet, where a two-color, two-step resonant laser ionization technique was applied for an unambiguous selection of a single element. The singly charged ^{192}Re$^+$ ions were extracted through the RF ion guides and reaccelerated at 20 keV, followed by mass separation using the KISS spectrometer.

During 4.2 days of data run, about 1.5×10^5 ^{192}Re nuclides were collected with an average intensity of 0.3 particles/s on a 12-μm-thick aluminized mylar tape at the end of the KISS beamline. The decay measurements were carried out with three different beam-on/off conditions of 90/180, 24/48, and 45/15 s in order to accommodate decays both from the ground state ($T_{1/2} = 16(1)$ s[4]) and from a previously reported long-lived isomer ($T_{1/2} = 61^{+40}_{-20}$ s[5]) in ^{192}Re. The implantation position was surrounded by a multi-segmented proportional gas counter (MSPGC) that covered 80% of the 4π solid angle with two layers of 16 counters.[6] The MSPGC was surrounded by four large-volume Clover-type HPGe detectors in a close geometry, having a γ-ray add-backed full-energy peak efficiency of 7.8% at 1 MeV.

Figure 1 shows an example of the β-delayed γ-ray coincidence spectrum and the decay scheme of ^{192}Re obtained in the present work. More details about the experimental results and physics discussion are described in Ref. 7).

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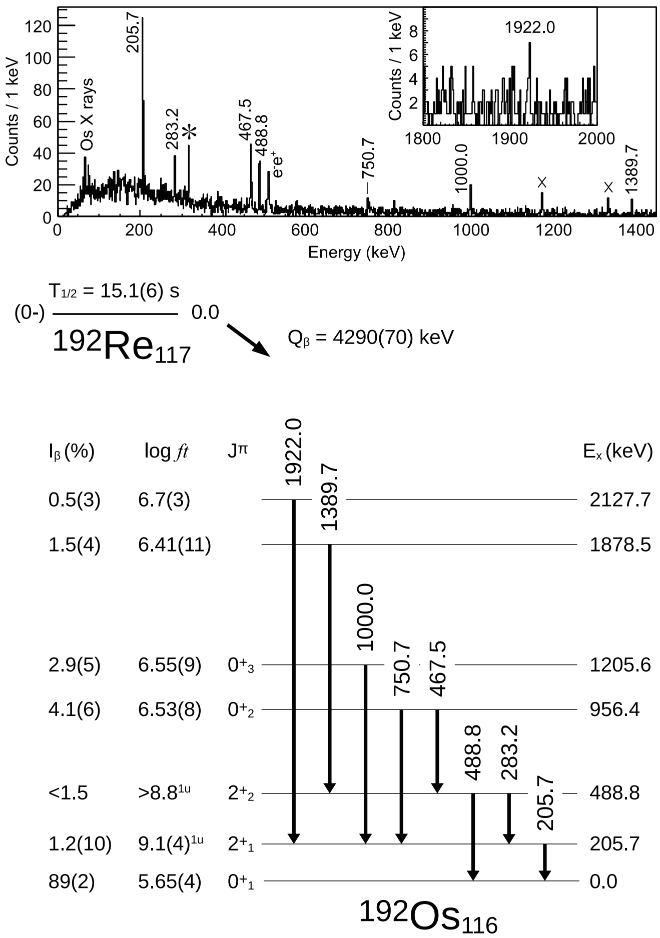

Fig. 1. Top: γ-ray energy spectrum measured in coincidence with MSPGC following implantation of ^{192}Re. Transitions in ^{192}Os are labeled with their energy values, while γ-ray peaks that originate from the room background and beam contaminants are marked with crosses and asterisk, respectively. The inset magnifies a high-energy region. Bottom: Level scheme of ^{192}Os populated in the β decay of ^{192}Re. The observed γ rays are consistent with those reported in Ref. 4). The superscript "1u" indicates first-forbidden unique β decay.

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