# In-gas-cell laser ionization spectroscopy of $^{200g}$Pt using MRTOF-MS at KISS

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Laser spectroscopy can be used to effectively investigate the nuclear structure througth the measured isotope shifts (IS) $\Delta\nu$, changes in the mean-square charge radii $\delta\langle r^2\rangle$, and quadrupole deformation parameters $|\langle\beta_2^2\rangle|^{1/2}$. In previous work[1)] related to $^{199g,199m}$Pt at the KEK Isotope Separation System (KISS),[2)] we reported the constant trend of $|\langle\beta_2^2\rangle|^{1/2} \sim 0.14$ ($N \geq 115$) approaching $N = 126$ deduced from the measured $\delta\langle r^2\rangle$ values using a droplet model. As a continuation of this work followed by $^{199g,199m}$Pt laser ionization spectroscopy toward $N = 126$ to investigate the trend of $\delta\langle r^2\rangle$ and $|\langle\beta_2^2\rangle|^{1/2}$ values and the nuclear structure of neutron-rich platinum nuclei, we performed the first laser ionization spectroscopy on $^{200}$Pt ($I^\pi = 0^+$ and $T_{1/2} = 12.6(3)$ h) using a multi-reflection time-of-flight mass spectrograph (MRTOF-MS) at KISS.

$^{200g}$Pt isotopes were produced via multi-nucleon transfer reactions by impinging a stable $^{136}$Xe beam (50 particle nA) with an energy of approximately 10 MeV/nucleon on a $^{198}$Pt target (12.5 mg/cm$^2$, enriched 91% and approximately 3% for each $^{194,195,196}$Pt). The singly charged isotopes, produced by the in-gas-cell laser ionization technique, with an energy of 20 keV were extracted from the KISS gas cell for hyperfine structure measurements. Using the MRTOF-MS, the extracted ions were identified and the number of the ions was determined. Futher details regarding the MRTOF-MS system can be found in Ref. 3).

Figure 1 shows the measured TOF spectrum of $^{200g}$Pt$^{2+}$ using the MRTOF-MS at KISS. The $^{200g}$Pt$^{2+}$ isotope can be clearly identified with the contaminant peaks of $^{200g}$Au$^{2+}$ and $^{200m}$Au$^{2+}$ ions ("$g$" and "$m$" indicate the ground and isomeric states, respectively), which were transported to the MRTOF-MS as the survived ions. The masses of these nuclei have already been precisely reported. To acculately evaluate the laser resonance spectrum of $^{200g}$Pt, we gated the relative time between 200 and 500 ns in Fig. 1 to deduce the number of ions detected by the MRTOF-MS. The laser resonance spectrum, shown in Fig. 2, was obtained by measuring the number of laser-ionized $^{200g}$Pt as a function of the laser wavelength. One resonance peak was observed, which stemmed from the atomic transition of $^{200g}$Pt due to $I^\pi = 0^+$. The fitting function was determined from the measured resonance spectrum of the stable nucleus of $^{198}$Pt with the same experimental conditions during beam time. From the measured peak position, we can determine the isotope shift value of $^{200g}$Pt to deduce the change in charge radius and discuss nuclear deformation. Using these results, we plan to investigate the systematic trend of IS values toward $N = 126$.

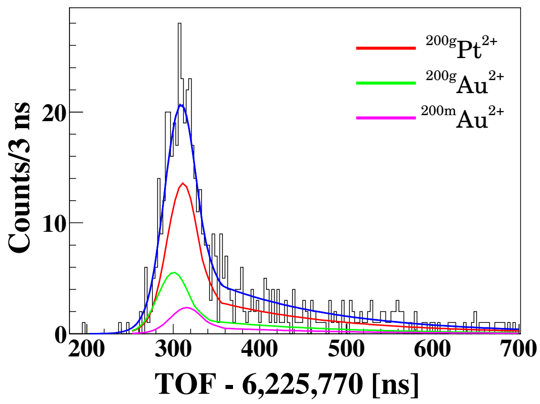


Fig. 1. Measured TOF spectrum of $^{200g}$Pt$^{2+}$.

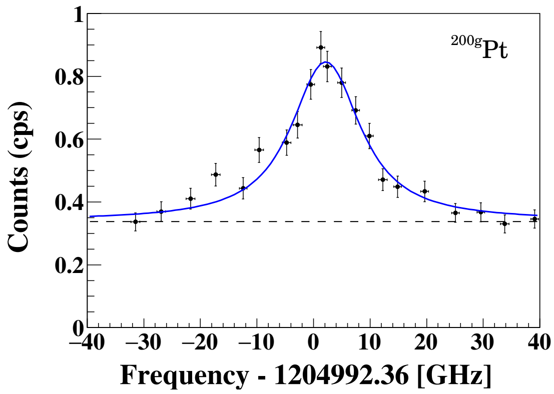


Fig. 2. Measured HFS spectrum of $^{200g}$Pt ($I^\pi = 0^+$). Horizontal uncertainty estimated from the accuracy of a wavemeter.

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