Neutron Capture and Total Cross Section Measurements on ^{194}Pt

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We have measured the neutron capture and total cross sections for ^{194}Pt from 20 eV to 330 keV at the Oak Ridge Electron Linear Accelerator (ORELA). The ^{194}Pt(n,γ) measurements were made on ORELA flight path 7 at a source-to-sample distance of 40 m using our standard C_6D_6 detector system. The total cross section (transmission) measurements were made on ORELA flight path 1 at a distance of 80 m. The samples were enriched to 96.47% in ^{194}Pt. The capture and transmission samples were 0.00168 at/b and 0.0236 at/b thick, respectively. The ORELA pulse width was 7 ns and the average power was 6-7 kW. Neutron capture and transmission measurements were also made on samples of natural platinum.

These were the first in a series of measurements on isotopes of platinum. The main goal is to determine the astrophysical reaction rate at *s*-process temperatures for the isotope ^{192}Pt. Because of its very small natural abundance (0.79%), only a small (approximately 400 mg), moderately enriched (57%) sample of this isotope could be obtained. Hence, to determine an accurate and precise astrophysical reaction rate for ^{192}Pt(n,γ) it is necessary to make separate measurements on the major "contaminant" isotopes (^{194,195,196}Pt) in the ^{192}Pt sample. We expect to begin measurements on ^{192,196}Pt in the near future.

As one of the heaviest s-only isotopes, ^{192}Pt serves as an important calibration point near the termination of the *s*-process path. This part of the s-process path is complicated by branchings at ^{191}Os and ^{192}Ir, so precise reaction rates for the nuclides near these branchings could help to refine properties of the s-process environment such as the temperature and neutron density. There is very little experimental information on the capture cross sections for any of the isotopes of platinum. To our knowledge, there have been no previous measurements of the (n,γ) cross sections at astrophysically relevant energies. Furthermore, theoretical estimates of the ^{192}Pt(n,γ) reaction rate at kT = 30 keV differ by as much as 50%.

A small part of the data for ^{194}Pt are shown in figure 1. We currently are fitting the data to obtain resonance parameters.

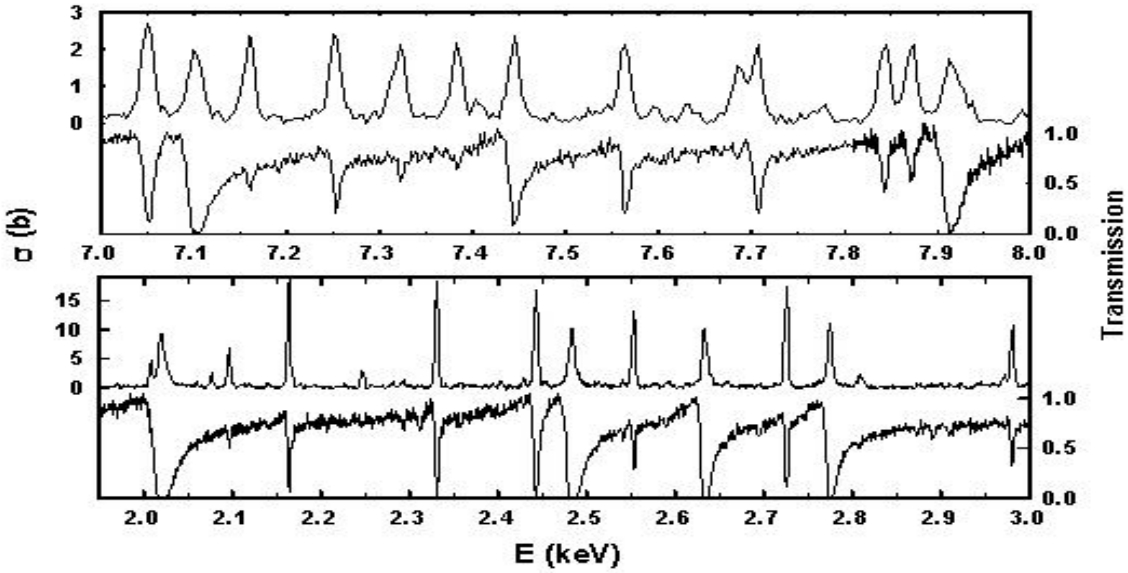

Figure 1: A small part of the capture and transmission data from our measurements on ^{194}Pt. The capture cross section is on top and the transmission on the bottom in each plot.

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