

# DEPARTMENT OF PHYSICS

# NUCLEAR SEMINAR

Monday, January 18

## *$^{89}\text{Zr}(n,\gamma)$ cross sections from a surrogate reaction approach*

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The surrogate reaction approach is an indirect method for determining nuclear reaction cross sections which cannot be measured directly or predicted reliably. While recent studies demonstrated the validity of the approach for studying fission cross sections of short-lived actinides, its applicability for radiative neutron capture reactions ((n, $\gamma$ )) is still under investigation. We studied the decay of excited  $^{90}\text{Zr}$  nuclei produced by  $^{90}\text{Zr}(p,p')$ ,  $^{91}\text{Zr}(p,d)$ , and  $^{92}\text{Zr}(p,t)$  surrogate reactions, respectively, in order to study the effect of the production mechanism on the decay of a compound nucleus and to infer the  $^{89}\text{Zr}(n,\gamma)$  cross sections. The experiments were carried out at the K150 Cyclotron facility at Texas A&M University with a 28.5-MeV proton beam. The reaction deuterons were measured at forward angles of 25-60 with the STARS array of three segmented Micron S2 silicon detectors. The compound nuclei with energies up to 8 MeV above the neutron separation thresholds were populated. The coincident  $\gamma$ -rays were measured with the Livermore Texas Richmond (LiTeR) array of five Compton-suppressed HPGe clover detectors. We will present results of emission probabilities from the different three reactions, which showed the  $^{90}\text{Zr}(p,p')$  reaction produces fewer  $\gamma$  rays associated with transitions involving high spin states ( $J = 6-8 \hbar$ ) than the other two reactions, suggesting that inelastic scattering preferentially populates states in  $^{90}\text{Zr}$  that have lower spins than those populated in the transfer reactions investigated. Theoretical approaches to obtain the  $^{89}\text{Zr}(n,\gamma)$  cross sections from these emission probabilities will be also discussed.

4 pm – 5 pm

**Nuclear Science  
Laboratory**

**124 Nieuwland  
Science Hall**

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All interested  
persons are  
cordially invited  
to attend

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Refreshments will be  
served prior to the  
seminar in room 124