Iranian Journal of Radiation Safety and Measurement
Vol. 12, No. 1, Spring 2023

# Study of spin increase effects calculated with CNS code based on MCNPX simulation code for $^{238,240,242,244}$Pu, $^{242,244,246,248}$Cm and $^{252,254}$Cf isotopes

**H. Zanganeh and M.N. Nasrabadi***

Faculty of Physics, University of Isfahan, 81746-73441, Isfahan, Iran
P.O. Box: 81746-73441
E-mail: mnnasrabadi@ast.ui.ac.ir

## Abstract

In the present research, the increase of nuclear spin effects on the fission barrier was studied for different nuclei. Then, the deposited energy in the target was calculated using MCNPX code. Based on F7 tally, the released energies due to fission and the neutron production rate were measured for $^{238,240,242,244}$Pu, $^{242,244,246,248}$Cm and $^{252,254}$Cf isotopes. It was shown that by increasing the spin of nuclei from $4^+$ to $26^+$, the rate of neutron production for different isotopes also increases. The simulation results showed that the increase in the energy of incident neutrons is proportional to the increase in the spin of the target nucleus. At last, the mutual effect of increasing spin on the nuclear deformation was investigated which indicates a good agreement with the simulation results. One of the most important results of this work is that neutron collision with any energy increases the spin of nucleus. Finally, based on the comparison, it was found that the results of CNS (Cranked Nilsson-Strutinsky) code are confirmed with that of MCNPX.

**Keywords: :** CNS, MCNPX, spin, fission barrier, neutron, nucleus deformation.

For full article, refer to the Persian section.

*Corresponding author: M.N. Nasrabadi, Tel.: +98 3137935058; Fax: +98 3137932723. E-mail address: mnnasrabadi@ast.ui.ac.ir