

## Laser production of medical isotopes $^{62,64}\text{Cu}$ and $^{68}\text{Ga}$ and nuclear isomer $^{93\text{m}}\text{Mo}$ using XingGuangIII laser facility

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Radioisotopes are indispensable agents in medical diagnosis and treatment, among which copper-62, 64 ( $\text{Cu-62, 64}$ ) and gallium-68 ( $\text{Ga-68}$ ) are medical isotopes widely used in positron emission tomography imaging. Nuclear isomer  $\text{Mo-93m}$  has a  $(21/2)^+$  isomer at 2,425 keV with a half-life of 6.85 h and a  $(17/2)^+$  intermediate state that lies 4.85 keV higher at 2,430 keV with a half-life of 3.5 ns. Such isomeric property is attractive to exploiting the depletion of nuclear isomers via nuclear excitation by electron capture. Furthermore, does the 'special isotope'  $\text{Mo-93m}$  affect the production of the debated p-nuclide  $\text{Mo-92}$  via the photoneutron reaction in stellar explosions? In this presentation, experimental investigation on laser production of  $\text{Cu-62, 64}$ ,  $\text{Ga-68}$ , and  $\text{Mo-93m}$  using the XingGuangIII laser facility is introduced (see Fig. 1). The prospect of producing the medical isotopes  $\text{Cu-62,64}$  and  $\text{Ga-68}$  is evaluated using a table-top femtosecond laser system of high repetition (see Fig. 2). The effect of nuclear reaction flow on the population of  $\text{Mo-93m}$  is studied. Then the  $\text{Mo-93m}$  involved photodisintegration reactions leading to the production of  $\text{Mo-92}$  is discussed. In addition, efficient generation of  $\text{Ho-164m}$ ,  $\text{Eu-150m}$  and  $\text{Eu-152m}$  via laser-induced nuclear reactions is shortly presented.

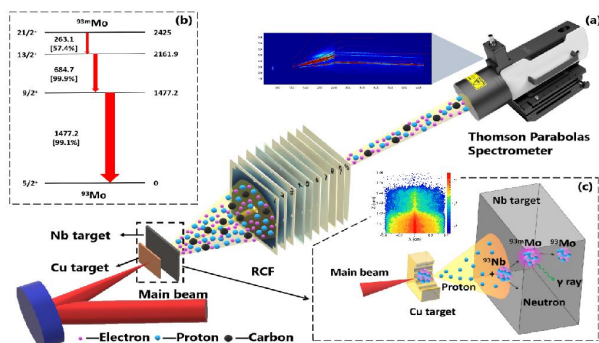


Fig. 1. (a) Schematic diagram of the experimental setup for nuclear isomer  $\text{Mo-93m}$  production at the XingGuang-III laser facility (not to scale). (b) Partial level scheme (not to scale) for the  $\text{Mo-93m}$  nucleus ( $Z = 42$ ). The right side of the panel gives the level energies (in keV) and half-lives, and the left side gives the angular momenta and parities. (c) Schematic diagram of the target arrangement for the laser proton acceleration and the following  $\text{Mo-93m}$  production.

### References

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