

## 2 - 18 Research Progress in the Exotic Nuclei Group

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### Decay study of light actinide nuclei on the gas-filled recoil separator SHANS

In order to study short-lived isotopes with submillisecond half-life and very low recoil energy, some technical improvements were made: (1) A VME data acquisition system was introduced to replace the old CAMMAC system. This allows to study isotopes with half-life down to  $\sim 10 \mu\text{s}$ . (2) Electrical isolation and filtering were introduced, the front end electronic noises have been reduced from  $\sim 8 \text{ MeV}$  down to  $\sim 2 \text{ MeV}$  and the 16 kHz noise produced by the engine of the rotating target system has been removed. (3) A cooling system for the energy degrader was installed and the degrader can be cooled to  $\sim 0^\circ\text{C}$ .

The reaction  $^{20}\text{Ne} + ^{209}\text{Bi}$  was used to search for new isotope  $^{224}\text{Np}$  using this improved rotating target system. No evidence for  $^{224}\text{Np}$  was observed for two reasons: (a) The transportation efficiency of SHANS is very low for this reaction and (b) The implantation profile of  $^{224}\text{Np}$  was found away from the implantation detectors, see Ref. [1] for details. A new energy calibration method has been developed and produces better energy resolution<sup>[2]</sup>.

### The SEASTAR collaboration

We joined the SEASTAR (Shell Evolution And Search for  $2^+$  energies At RIBF) collaboration at RIKEN and we are analyzing the data of n-rich V and Mn isotopes with  $N \sim 40$ . The method of the data analysis is introduced briefly in Ref. [3].

### Design of the Radio Frequency Fragment Separator (RFFS) at RIBLL

Strong contaminations are present for proton-rich radioactive beams on RIBLL due to the projectile fragmentation reaction mechanism at intermediate energy ( $50 \sim 200 \text{ MeV/u}$ ). A radio frequency deflector is being designed to increase the fraction of proton rich nucleus of interest. The location (T1 or T2 on RIBLL) and the deflection mode have been investigated using the LISE++ software which includes the RF separator. It is found that the purity of p-rich beam could be increased remarkably, *e.g.*, the purity of  $^{53}\text{Ni}$  produced by the fragmentation of  $^{58}\text{Ni}$  primary beam can be increased  $\sim 100$  times. Grant for building a RFFS on RIBLL has been applied for.

### Study of the proton emitter $^{151}\text{Lu}$

The in-beam and decay spectroscopy of  $^{151}\text{Lu}$  were performed on the gas filled separator RITU at JYFL. The level scheme of  $^{151}\text{Lu}$  has been extended and the half-lives of the g.s. and isomeric proton decays have been re-measured with improved precision.

### References

- [1] Tianheng Huang. IMP HIRFL Annual Report.
- [2] Mingdao Sun. IMP HIRFL Annual Report.
- [3] Bing Ding. IMP HIRFL Annual Report.