



Second SPES International Workshop

26-28 May 2014 INFN Laboratori Nazionali di Legnaro  
Europe/Rome timezone



# The search of double magic superheavy nucleus in the region of neutron shell at $N=184$

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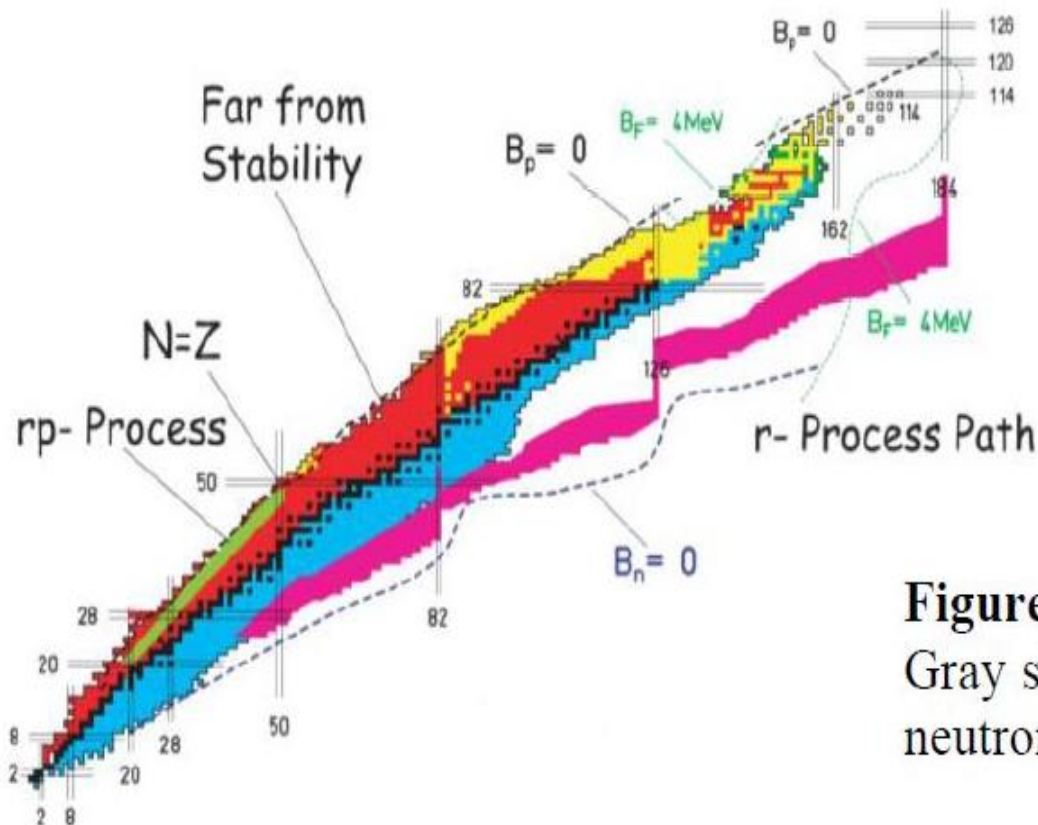


- The aim of the Collaboration is to joint efforts for the investigation of the dynamics and properties of the fusion-fission and quasi-fission process of the superheavy elements
- the search of double magic superheavy nucleus in the region of neutron shell at  $N=184$
- and study of their properties in binary processes of multi nucleon transfer reactions and quasifission.



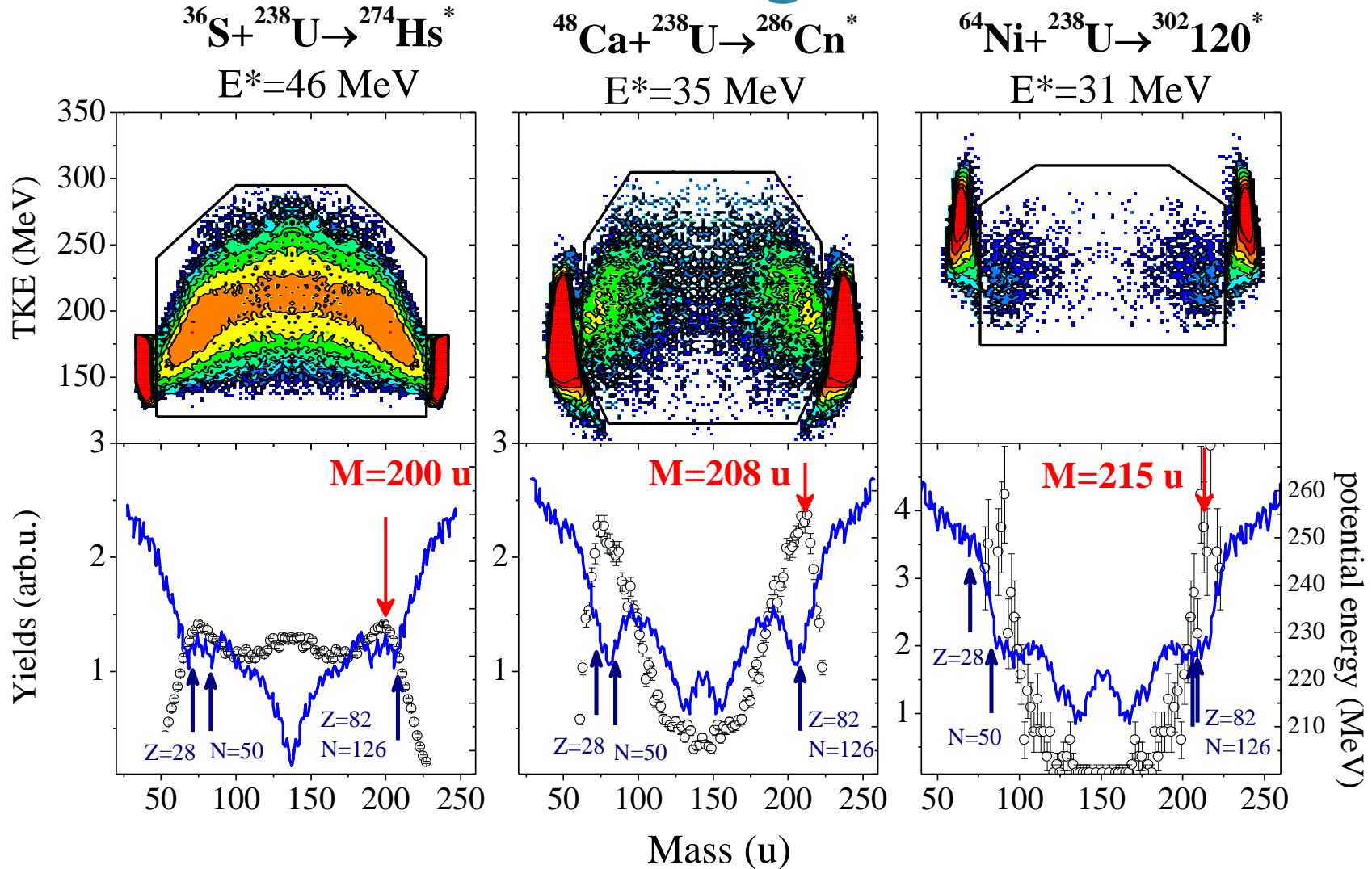
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**Figure 1.** Nuclear map as it looks today. Gray strips indicate positions of proton and neutron closed shells.

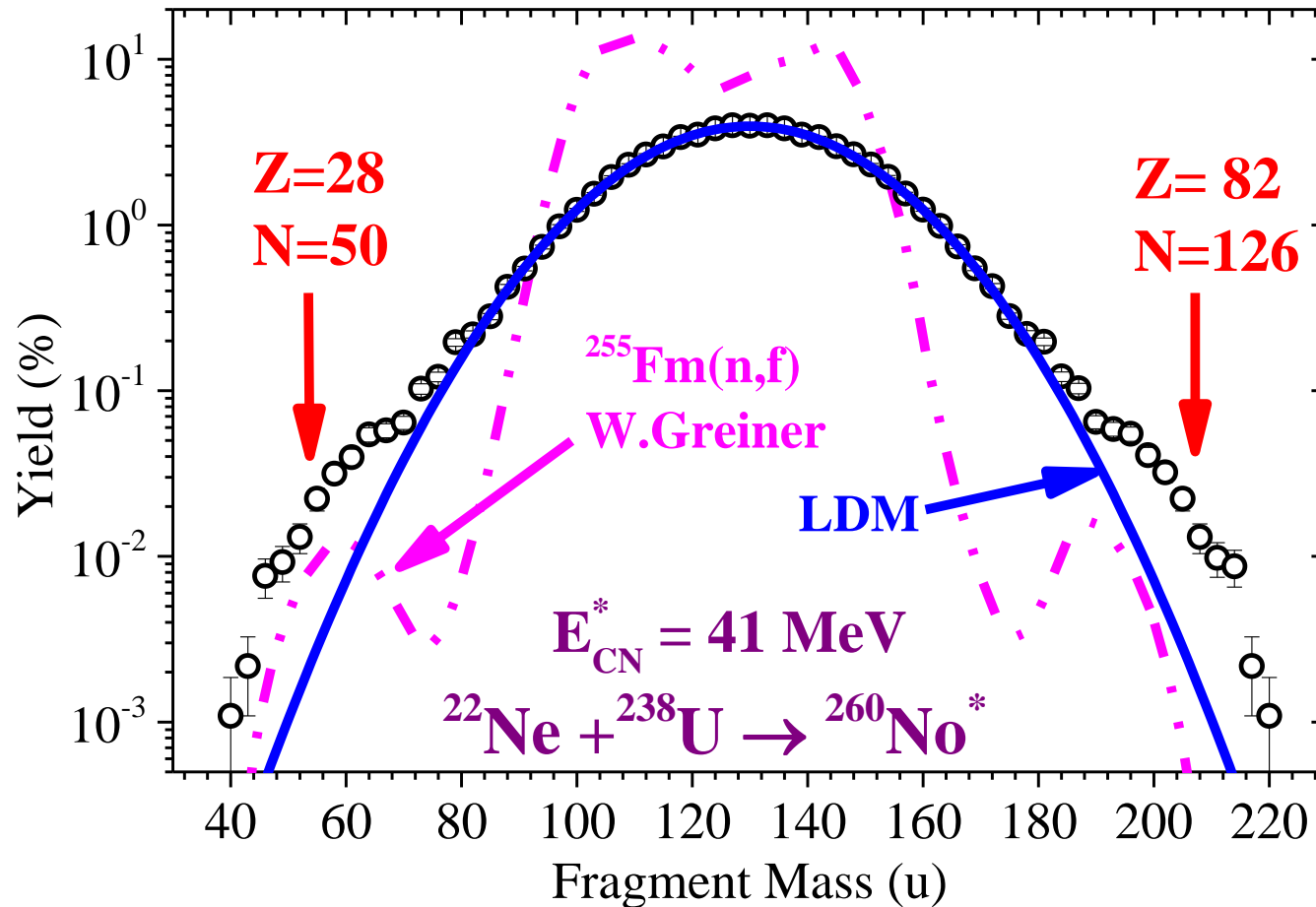
# Mass-energy distributions of binary reaction fragments



•G.N. Knyazheva, I. Itkis, E.M. Kozulin. The time scale of quasifission process in the reactions with heavy ions. International Symposium Entrance Channel Effect on the Reaction Mechanism in Heavy Ion Collisions, Messina (Italy) - November 6-8, 2013, *Journal of Physics: Conference Series* 515 (2014) 012009.

Driving potentials are calculated with NRV code ([nrv.jinr.ru](http://nrv.jinr.ru))

# Shell effects in Asymmetric fission



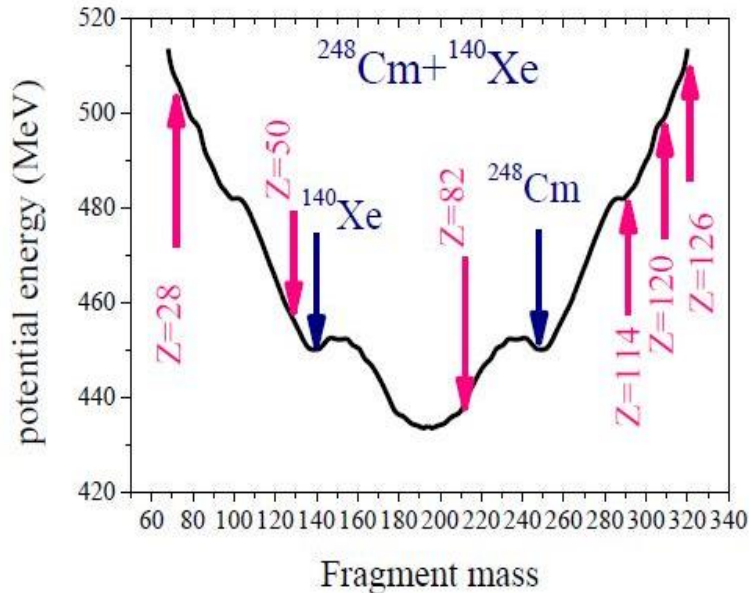
## Mass distribution of fission fragments of $^{260}\text{No}$

- Blue line – mass distribution, calculated in the framework of the LDM;
- Dash-dot line – the calculations of W. Greiner for  $^{256}\text{Fm}(n^{\text{th}}, f)$  taking into account the shell corrections.



## The search of double magic superheavy nucleus in the region of neutron shell at $N=184$

We propose to perform the measurements of the cross sections for the production of new neutron rich nuclei located along the closed neutron shell  $N=184$  using the beam of  $^{140}\text{Xe}$  providing by SPES facility in collisions with  $^{248}\text{Cm}$  target by the two-arm detection system **PRISMA** or **PRISMA+CORSET**.



**Figure 4.** Potential energy at scission point as a function of the primary fragment mass in the reaction  $^{248}\text{Cm} + ^{140}\text{Xe}$ . The arrows indicate the positions of proton shells.



## The experimental method

PRISMA is a large-acceptance variable-mode magnetic spectrometer allowing to identify A and Z of the (lighter) projectile-like fragments. The second arm allows to identify A of target-like fragments with using of ToF-ToF method. Due to the fact that the probability of light charge particles emission (proton, alpha) is extremely small for such kind of the reactions we may obtain the Z of target-like fragments as  $Z_{\text{target}} + Z_{\text{projectile}} - Z_{\text{PLF}}$  with precision of about  $\pm 1\%$ . This accuracy for charge identification of target-like fragments is enough to observe the shell effect manifestation in region neutron shell  $N=184$



## *RATE ESTIMATES AND BEAM TIME REQUEST*

- **beam:**  $^{140}\text{Xe}$ , about  $10^7$  p/s, 870 MeV, continuous
- **target:**  $^{248}\text{Cm}$ ,  $300 \mu\text{g}/\text{cm}^2$ , backing: two  $15 \mu\text{g}/\text{cm}^2$  C-layers
- **experimental setup:** PRISMA or PRISMA+CORSET
- **counting rate:** 5-50 events in during 10 days for each of the nuclei in region neutron shell  $N=184$  with formation cross section  $\sim 10\mu\text{b}$
- **beam time:** taken into account the parameters of PRISMA set-up, we require **10 days** beam time





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**Thanks for your attention!**

