

Results and Discussion

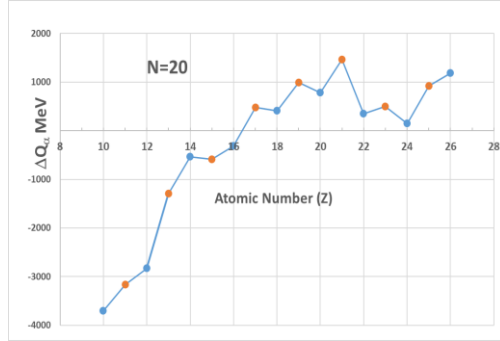


Fig.2 The variation of Q value difference for N=20.

Thus, the sign of the differences along with its magnitude is also important for understanding. Let us now systematically analyze the plots for specific magic numbers one by one.

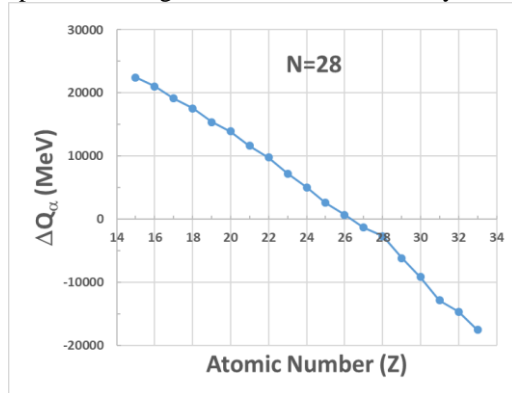


Fig.3 The variation of Q value difference for N=28.

- For N=20, all the Q values are negative. Thus, negative ΔQ_α for $Z < 17$ indicates that for those elements, the Q value of the isotope with (Magic no+2) neutrons is more negative than that of the isotope with magic neutron number, indicating absence of a dip or minimum at N=20. However, for $Z > 16$, the dip prevails and the magicity of N=20 persists. Moreover, the peak of the plot is at Ca, which is a doubly magic nucleus for N=20 indicating the most stable N=20 nucleus.
- The other interesting feature in the plot is the odd-even staggering of the differences. Whether the lower ΔQ_α for even Z nuclei above $Z=16$ indicate possibility of alpha clustering needs more detailed analysis.
- The Fig. 3 for N=28 is almost featureless, devoid of the odd-even staggering. For $Z > 26$,

the nuclei become more proton-rich with N=28, thus stability reduces and effect of magicity too.

- For N=50 and 82, all the differences are positive and thus indicate the robustness of the magic numbers with the most stable combinations being with $Z \sim 40$ and $Z \sim 50$, respectively, indicated by peaks in the plots.
- However, staggering is observed N=50 for a limited region in contrast to the N=82 plot.

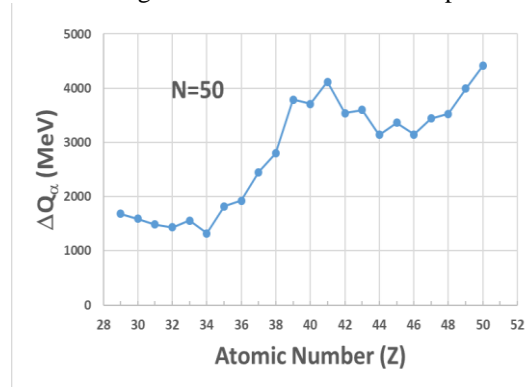


Fig.4 The variation of Q value difference for N=50.

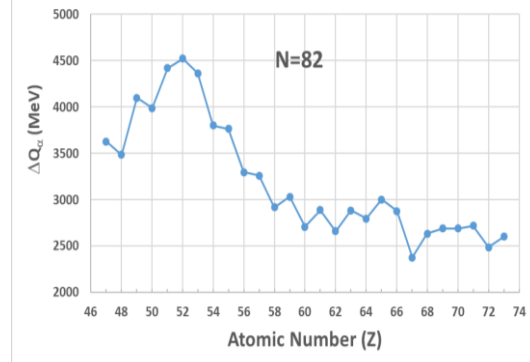


Fig.5 The variation of Q value difference for N=82.

The preliminary analysis of the results indicates very interesting possibilities of exploiting this mass filter for studying shell evolution in atomic nuclei. They can be also utilized as a sensitive indicator to study alpha clustering.

Acknowledgments

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References

1. ATOMIC MASS DATA CENTER: <http://amdc.impcas.ac.cn/web/masseval.html>