Structure and shape evolution in ^{75}Ge

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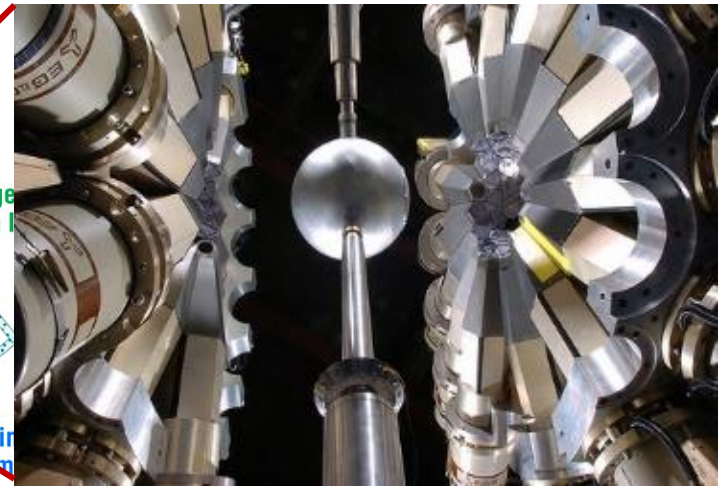
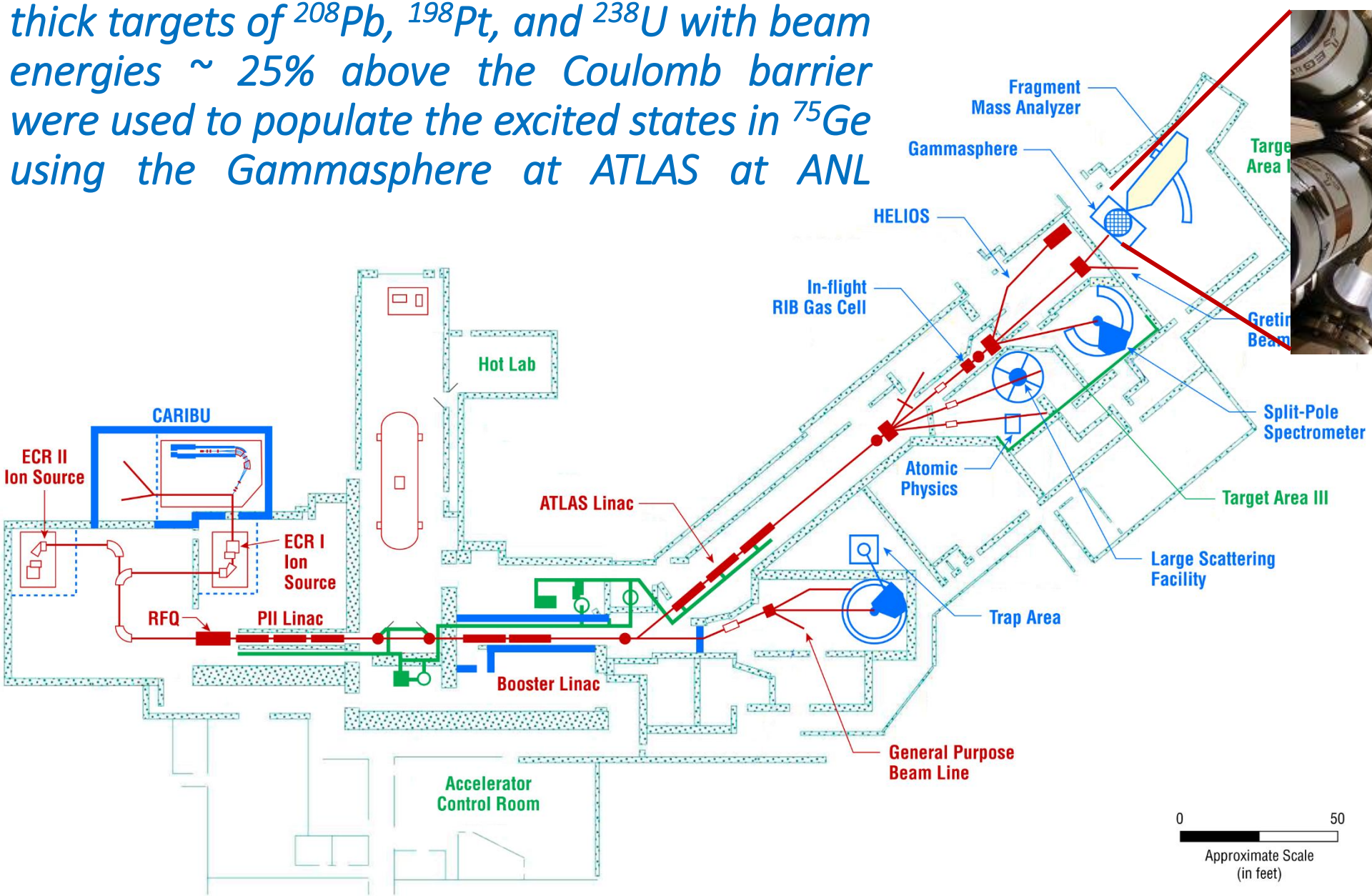
Motivation

- Ge isotopes in the vicinity of the N=40 transitional region are very sensitive to shape changes with addition of nucleons due to the spacing of neutron orbitals in the *fpg* model space.
- Higher mass N=43 isotones are known to exhibit shape evolution and the previous experiments indicate a possibility of shape change in ^{75}Ge.
- It is interesting to explore the region of triaxiality near ^{76}Ge; the sole example of a rigid triaxial nucleus in this mass region.
- High spin studies are crucial to complement results from transfer, (n,γ) reactions and β-decay studies as they provide information on new high-spin levels and assignment of spins and parities leading to a better understanding of neutron and proton configurations.

Experimental Set-up and details

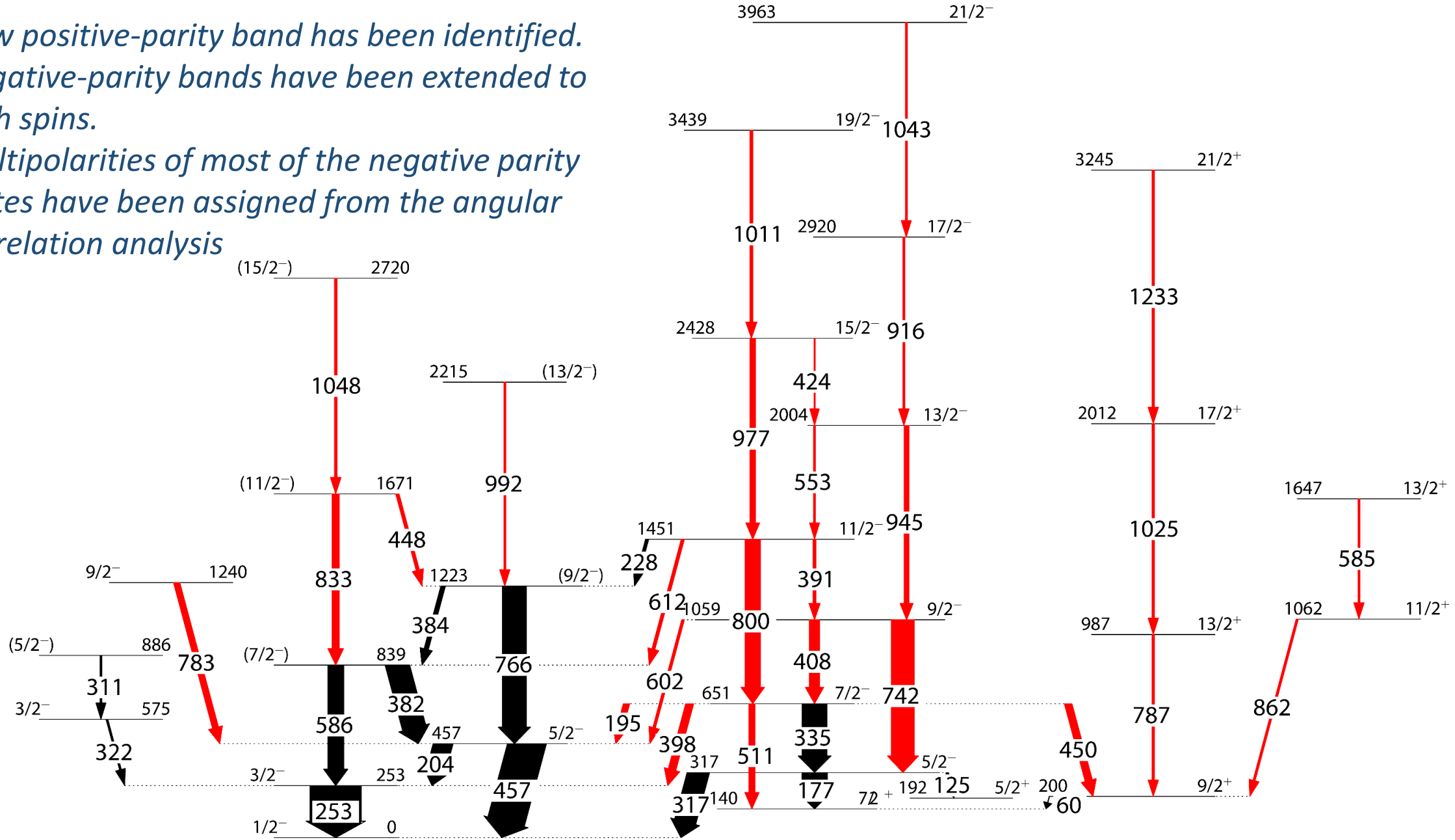
Deep-inelastic reactions with ^{76}Ge beam on thick targets of ^{208}Pb, ^{198}Pt, and ^{238}U with beam energies ~ 25% above the Coulomb barrier were used to populate the excited states in ^{75}Ge using the Gammasphere at ATLAS at ANL



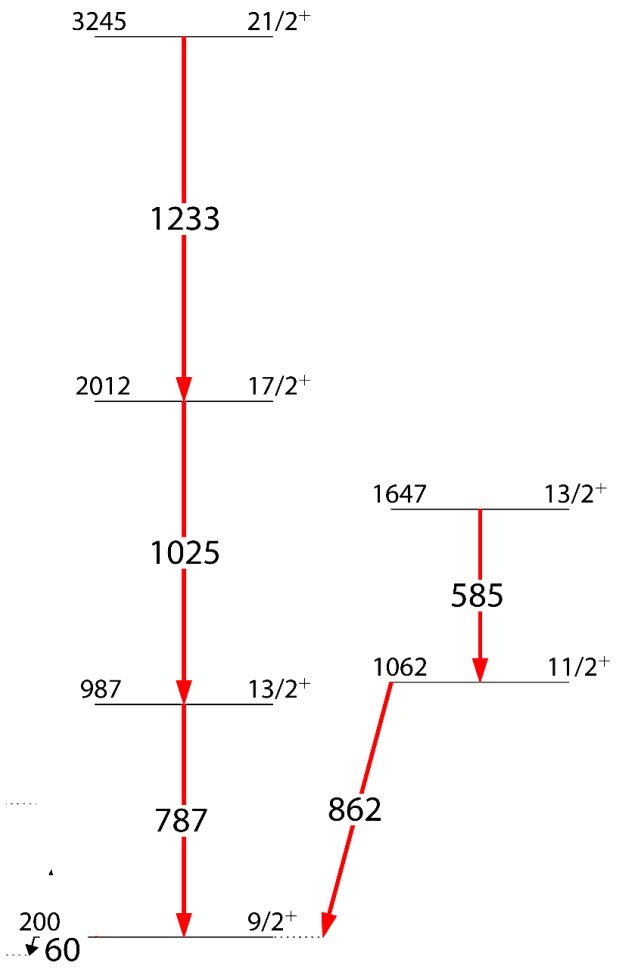


Level Scheme of ^{75}Ge

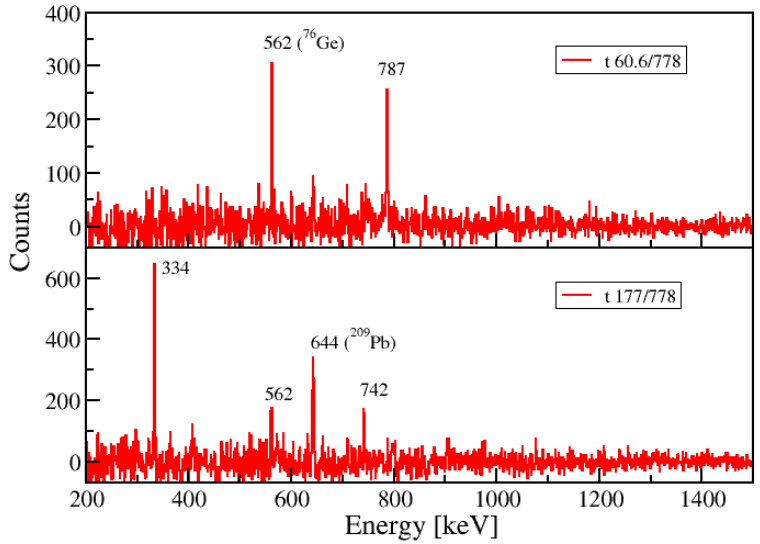
- *New positive-parity band has been identified.*
- *Negative-parity bands have been extended to high spins.*
- *Multipolarities of most of the negative parity states have been assigned from the angular correlation analysis*



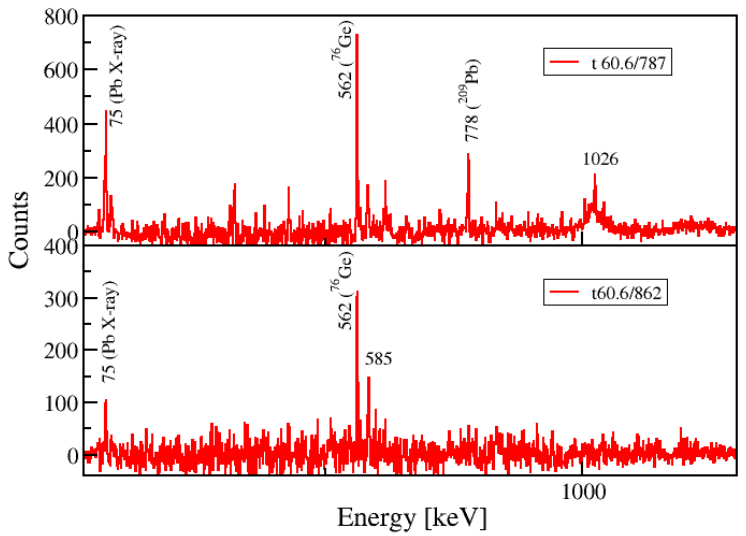
New positive-parity band



Cross correlations between ^{75}Ge and ^{209}Pb



Spectra showing high spin transitions of the positive parity band



Double gated spectra showing high spin transitions in ^{209}Pb and transitions feeding the $9/2^+$ level in ^{75}Ge.

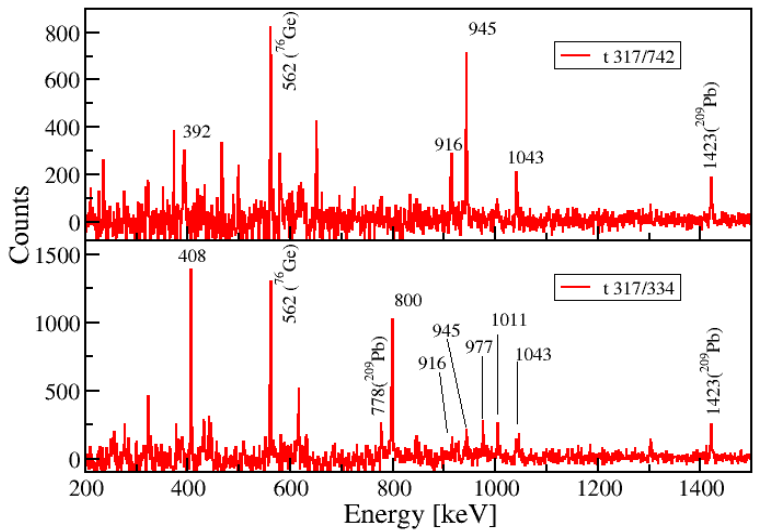
New positive-parity band

A new positive-parity band has been identified by cross-correlating coincidences with the complementary recoil ^{209}Pb from the ^{76}Ge + ^{208}Pb data and the same was confirmed in ^{76}Ge on ^{198}Pt and ^{238}U data sets.

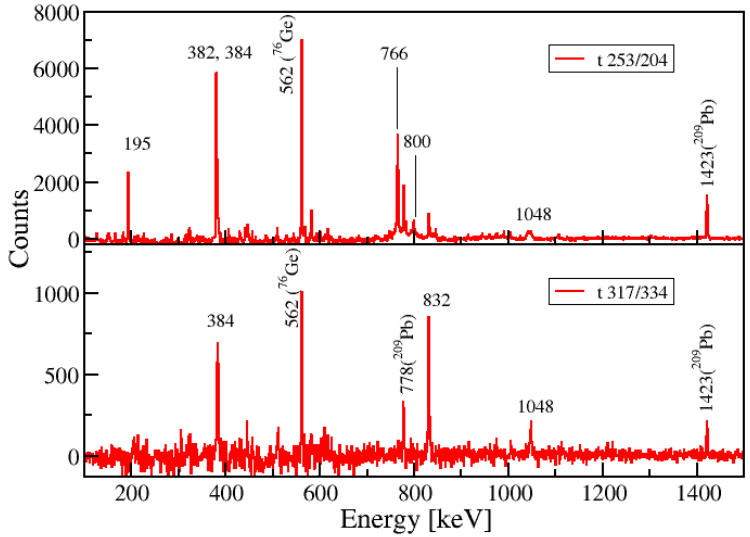
The positive-parity was extended upto 21/2 $\hbar$ and can be interpreted to be built on the $\nu g_{9/2}$ configuration. We propose this band to have positive parity being built on the $9/2^+$ bandhead.

Negative-parity bands

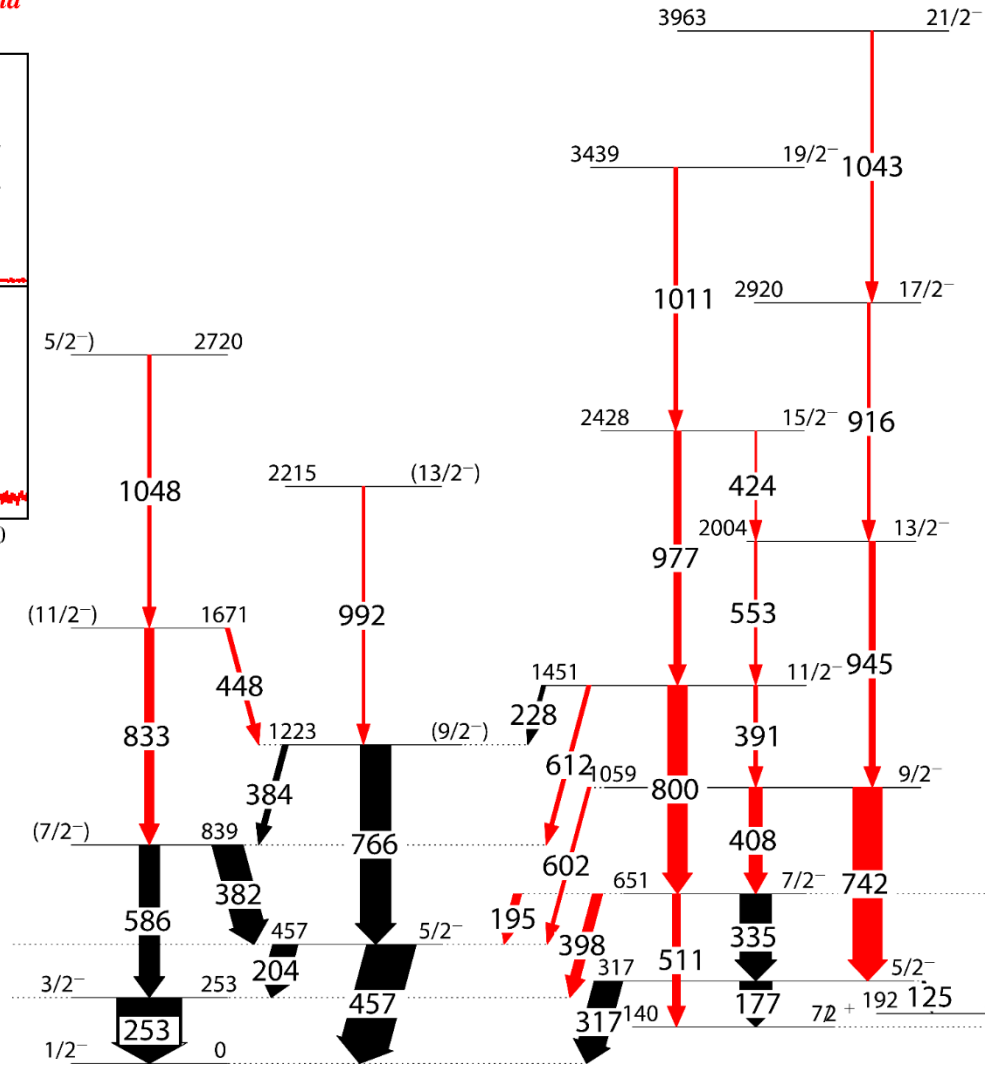
Spectra showing transitions of the yrast negative parity band



Spectra showing transitions second negative parity band



Double gated spectrum for both the negative-parity bands showing the high spin transitions of these bands built on the $1/2^-$ ground state.



Negative-parity bands

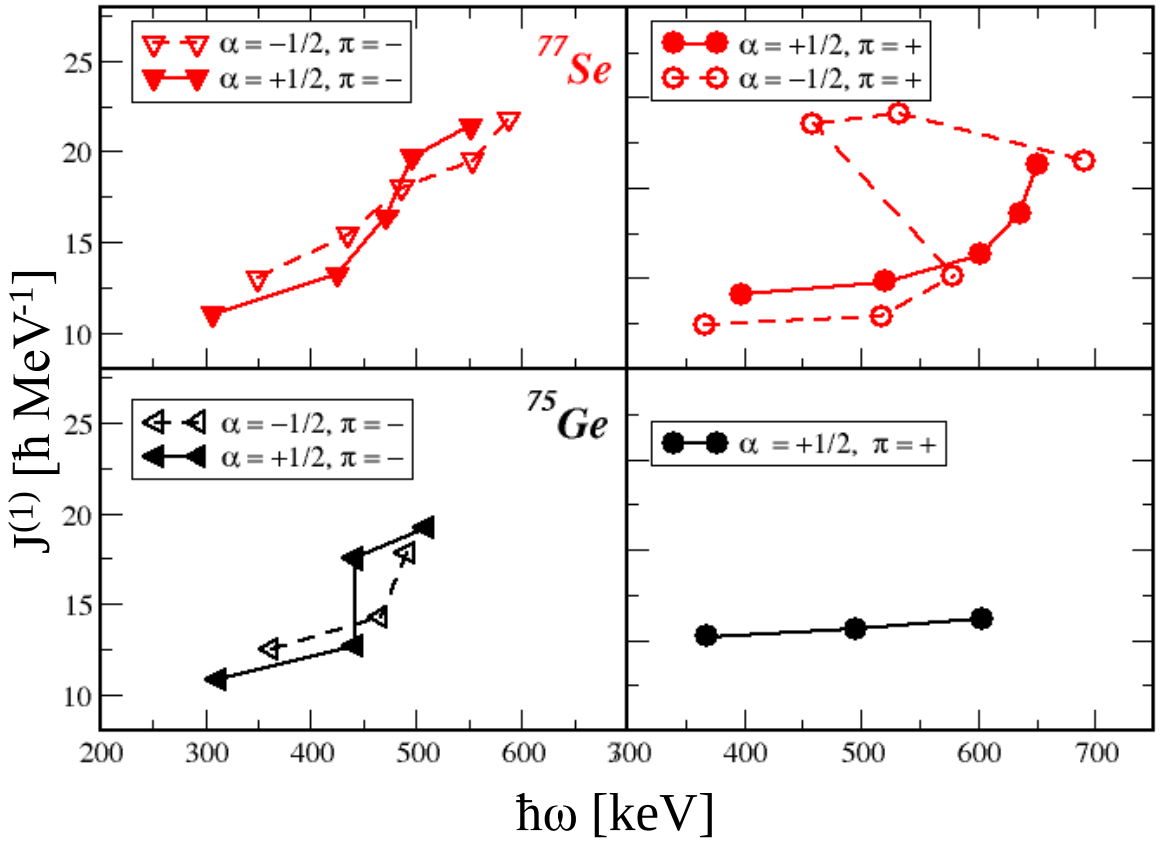
Both negative-parity bands have been extended to higher spins. From the previous works the levels above $9/2^-$ were not known.

The negative parity states can be interpreted in terms of $\nu p_{1/2}$ coupled to the prolate deformed ^{74}Ge core.

Comparison of ^{75}Ge with ^{77}Se isotone

A comparison of kinematic moment of inertia *vs* rotational frequency is plotted for ^{77}Se and ^{75}Ge yrast negative parity band (left) and the new positive parity band (right)

- *A similar up bend is observed in both the nuclei for the lowest negative-parity bands which can be attributed to quasiparticle alignment.*
- *For the positive parity band, a similar trend can be expected but further experimental investigation is required.*



Conclusion

- *The level scheme of ^{75}Ge has been extended to high spins*
- *First observation of levels upto 21/2 ħ for both negative parity and positive parity band.*
- *Spins and parities have been assigned to most of the negative parity states deduced from the angular correlation analysis.*
- *Comparison of the moment of inertia of ^{75}Ge with ^{77}Se isotone, suggests a similar structure and comparable deformation in both the nuclei.*
- *No evidence of triaxiality has been found in ^{75}Ge, more experimental investigation is required.*

Thank you

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