Study of the Ni-isotopic chain in real photon-scattering experiments

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COMEX7

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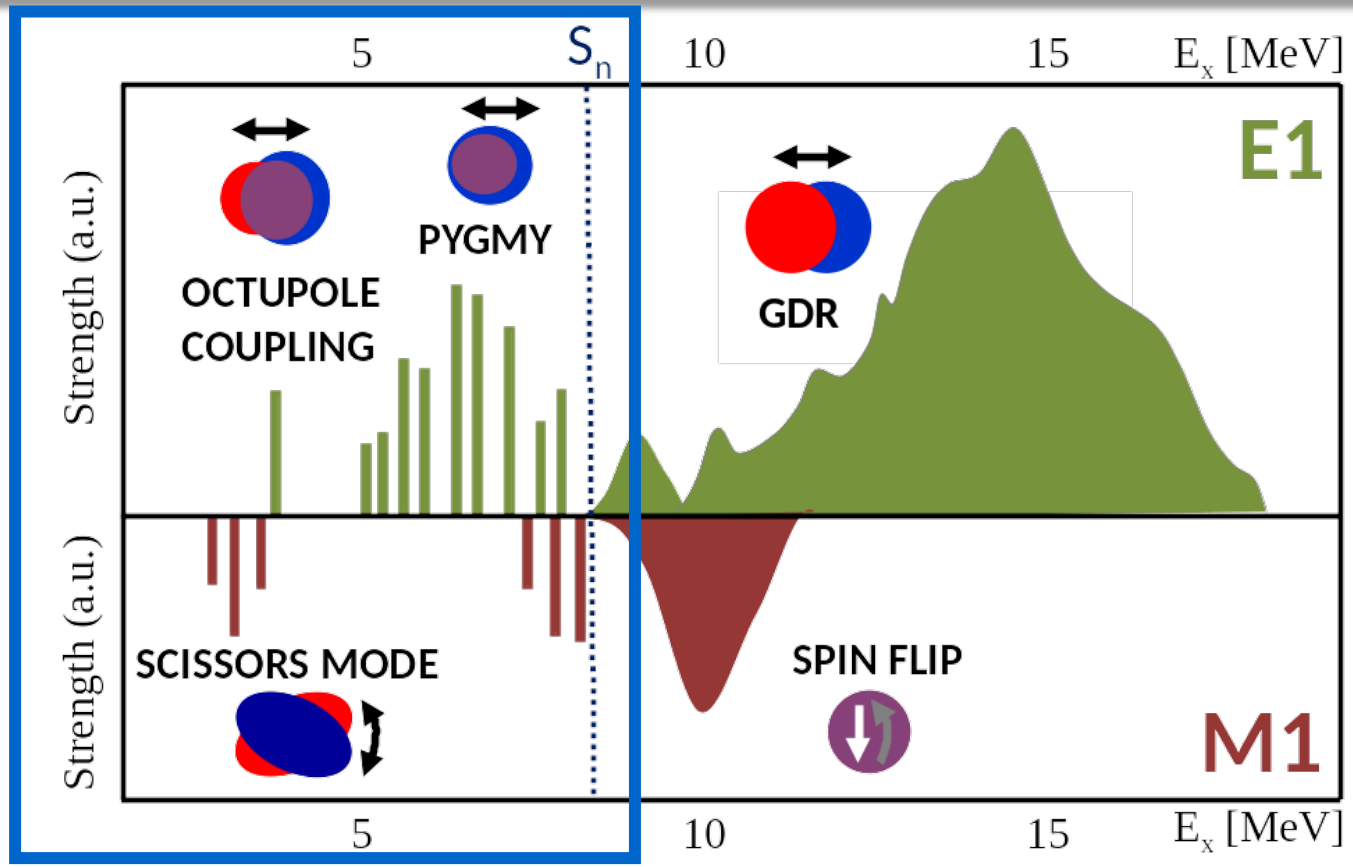
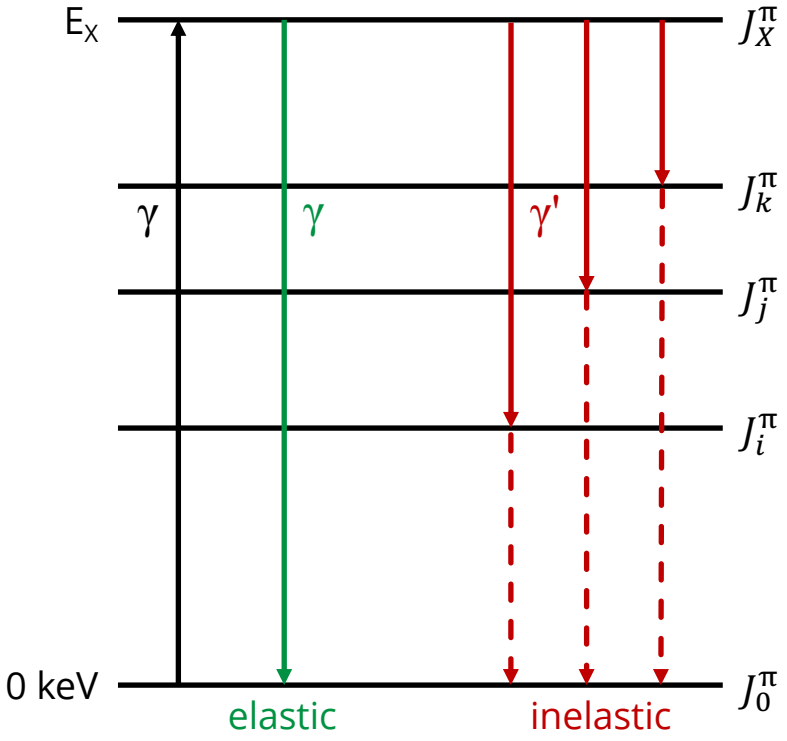
Dipole-excitation modes



Adopted from A. Zilges *et al.*, J. Phys.: Conf. Ser. **580** (2015) 012052

Real photon-scattering experiments

Nuclear Resonance Fluorescence (NRF) method

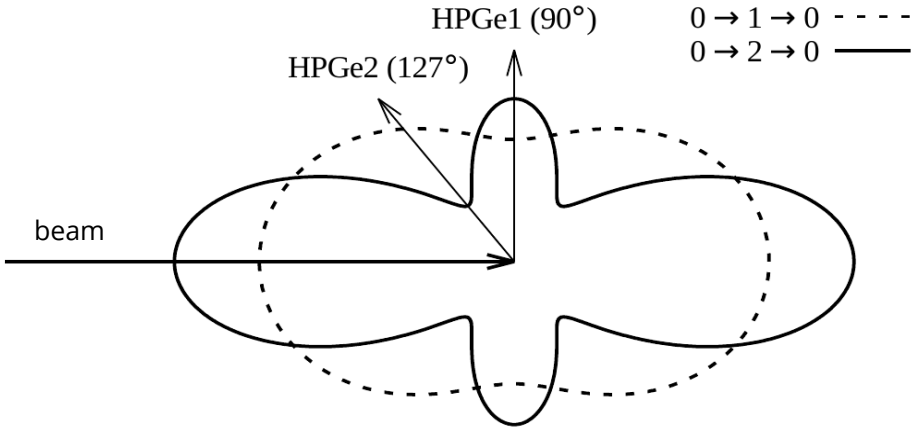


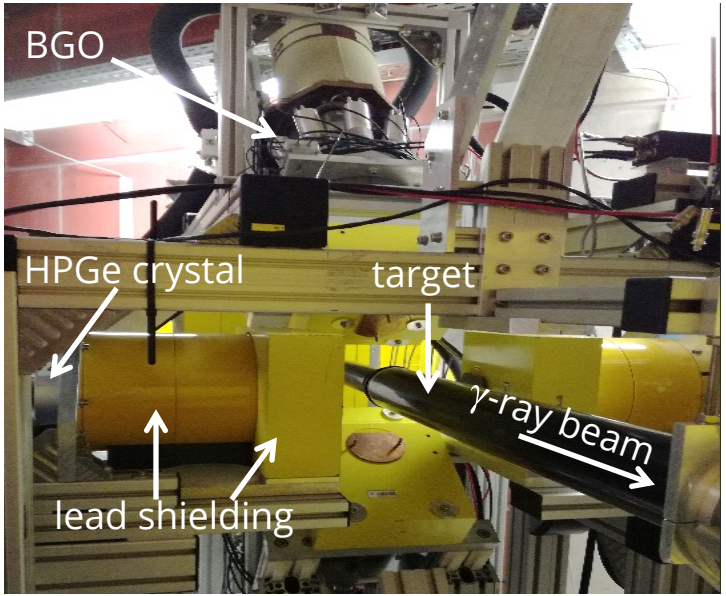
model-independent extraction of:

- level energies
- spin quantum numbers
- parity quantum numbers
- level lifetimes and total decay widths
- γ-decay branching ratios
- absolute photoabsorption cross sections
- …

Bremsstrahlung experiments on ^{64}Ni

bremsstrahlung measurements @ γELBE (HZDR, Germany) with E_{max} = 7.3 MeV (LE) and 9.4 MeV (HE) → energetically-continuous photon-flux distribution





γELBE: R. Schwengner *et al.*, NIM A **555** (2005) 211

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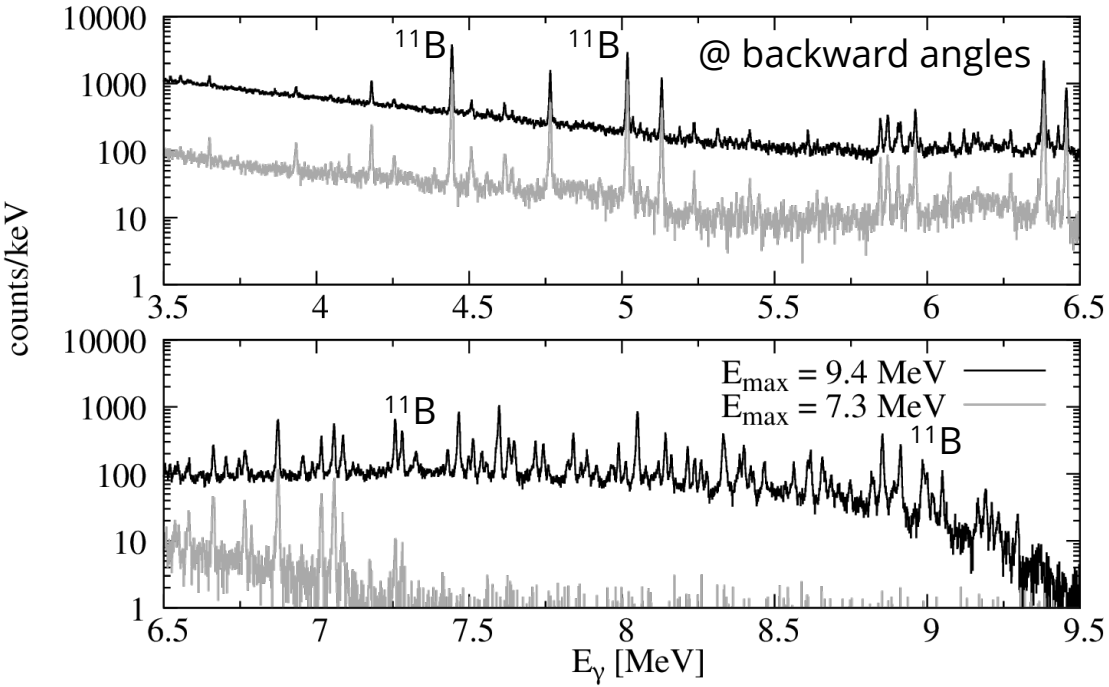

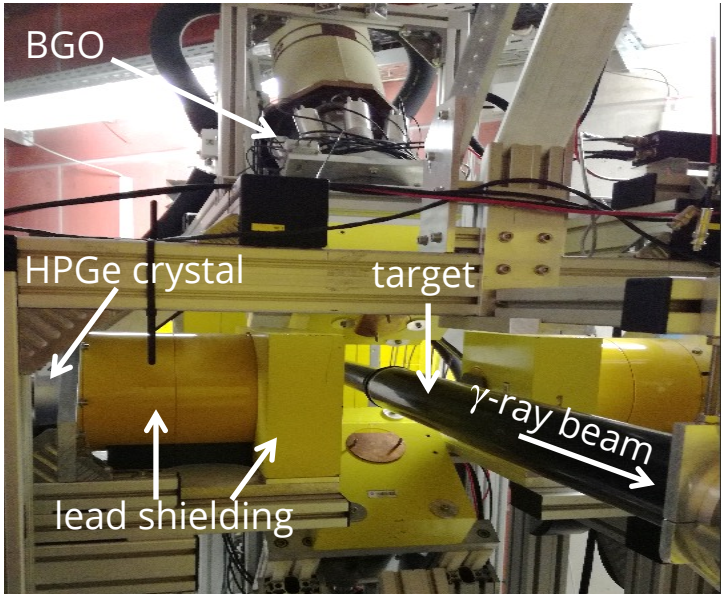

usage of calibration standard → absolute transition strengths

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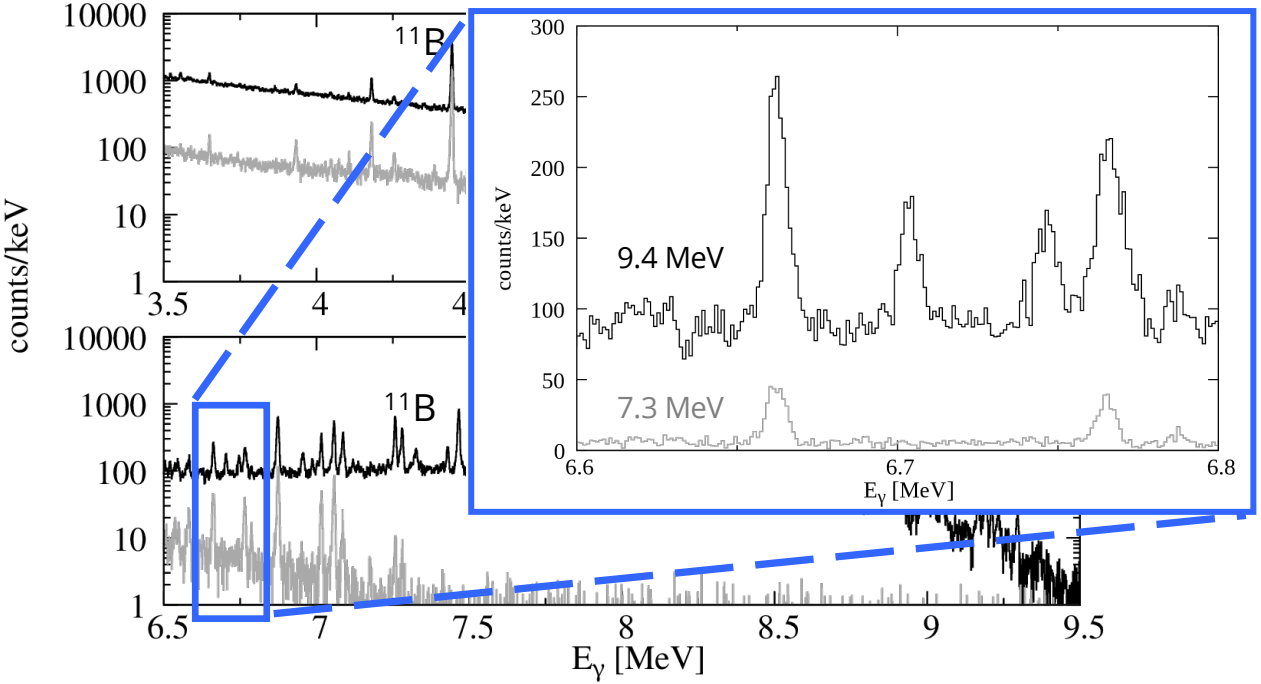

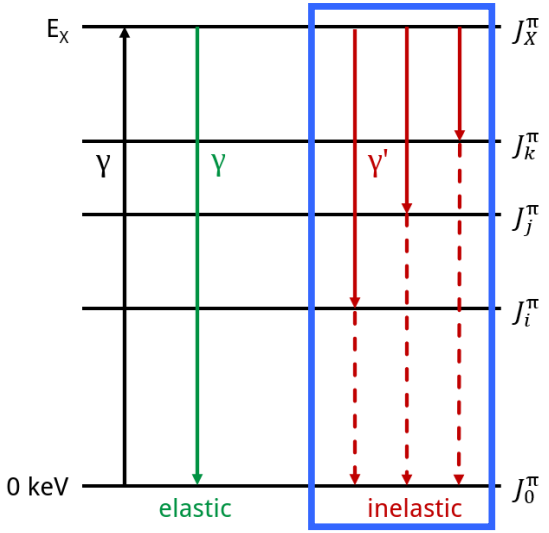

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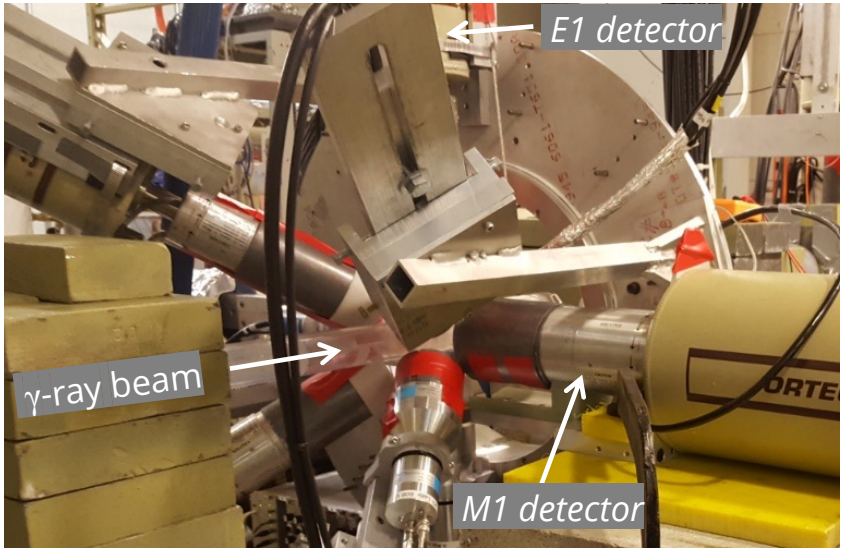
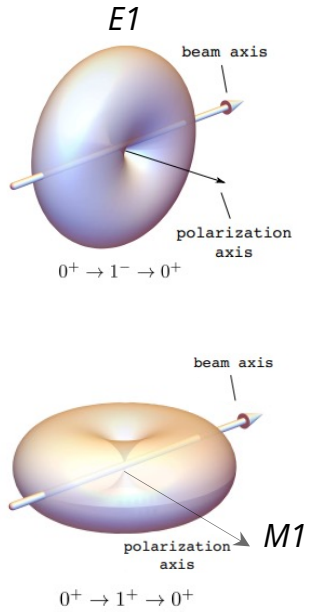
Laser-Compton-Backscattering experiment on ^{64}Ni

experiment @ HIγS (Duke University, USA) using linearly-polarized, quasimonoenergetic γ rays (26 energies 4.3 - 10.0 MeV)





HIγS: H.R. Weller *et al.*, PPNP **62** (2009) 257
γ^3 setup: B. Löher *et al.*, NIM A **723** (2013) 136

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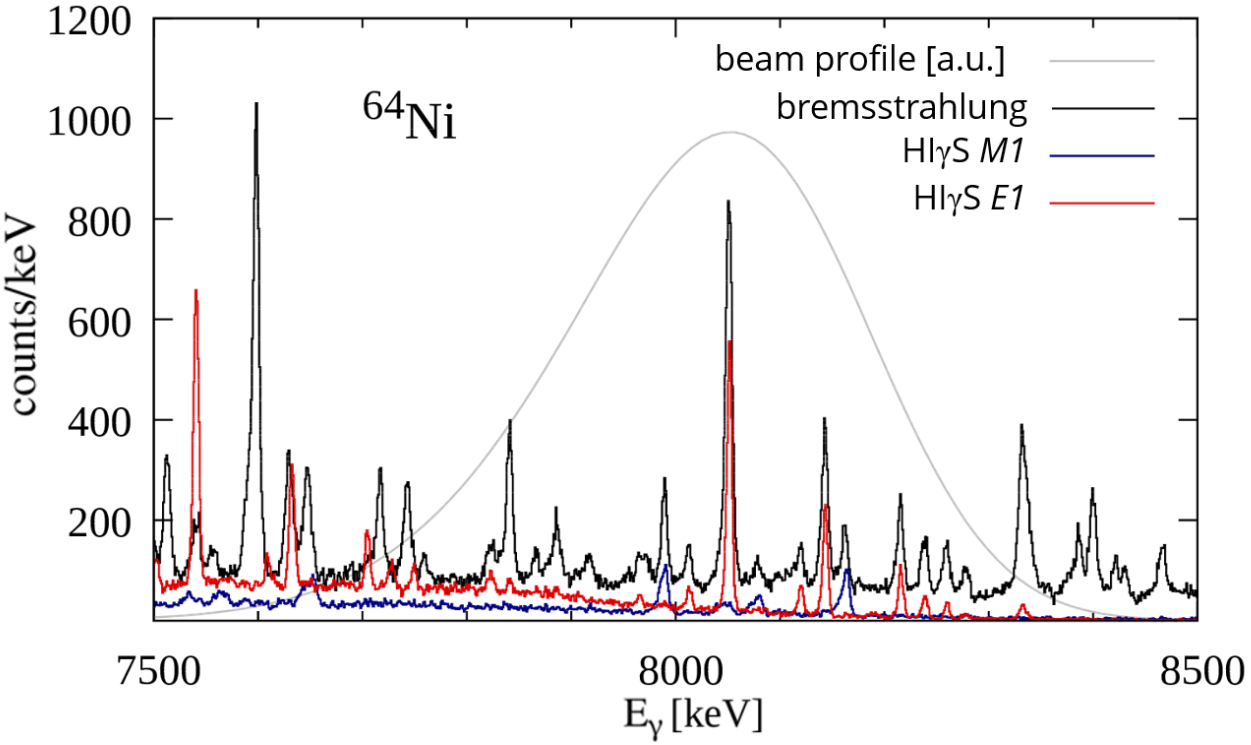

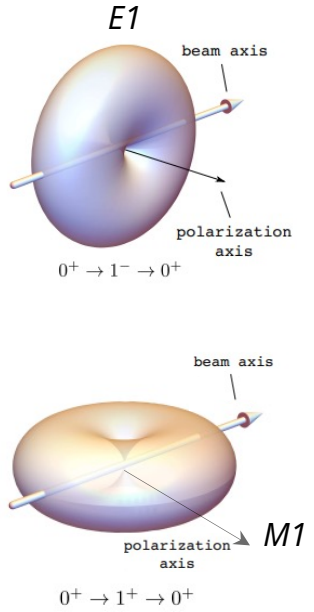

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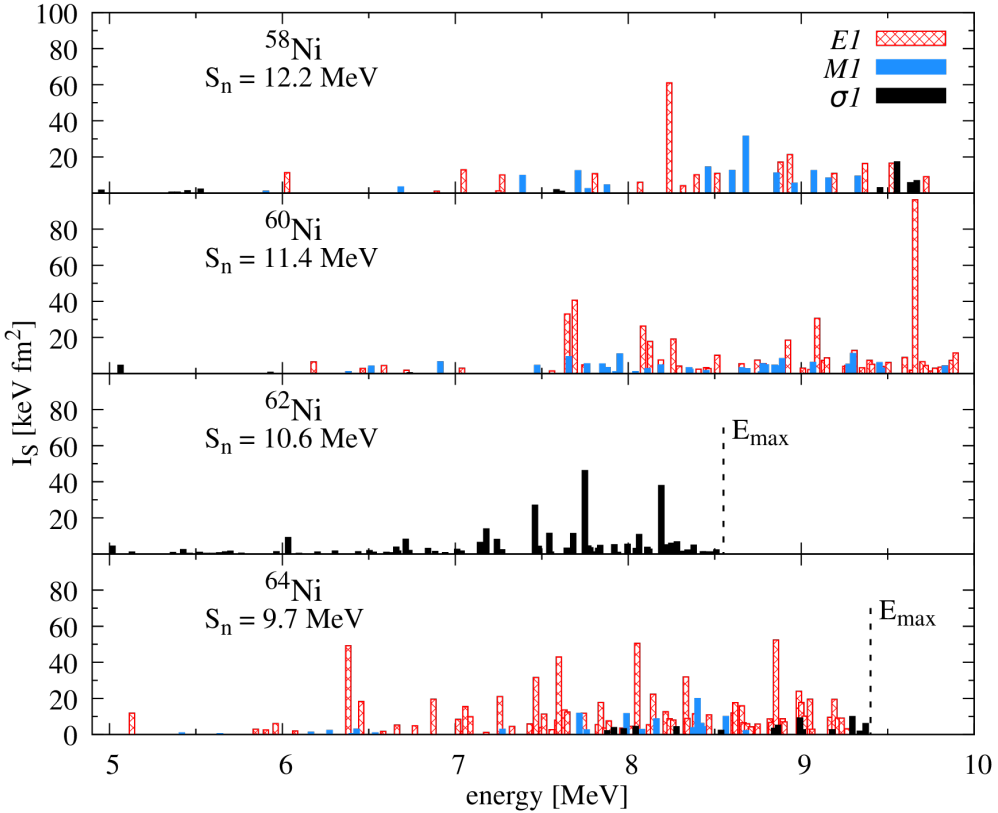
γ^3 setup: B. Löher *et al.*, NIM A **723** (2013) 136

State-to-state results: Z = 28 isotopic chain



F. Bauwens *et al.*, Phys. Rev. C **62** (2000) 024302

M. Scheck *et al.*, Phys. Rev. C **87** (2013) 051304R
M. Scheck *et al.*, Phys. Rev. C **88** (2013) 044304

T. Schüttler, Bachelor's thesis, Cologne (2023)

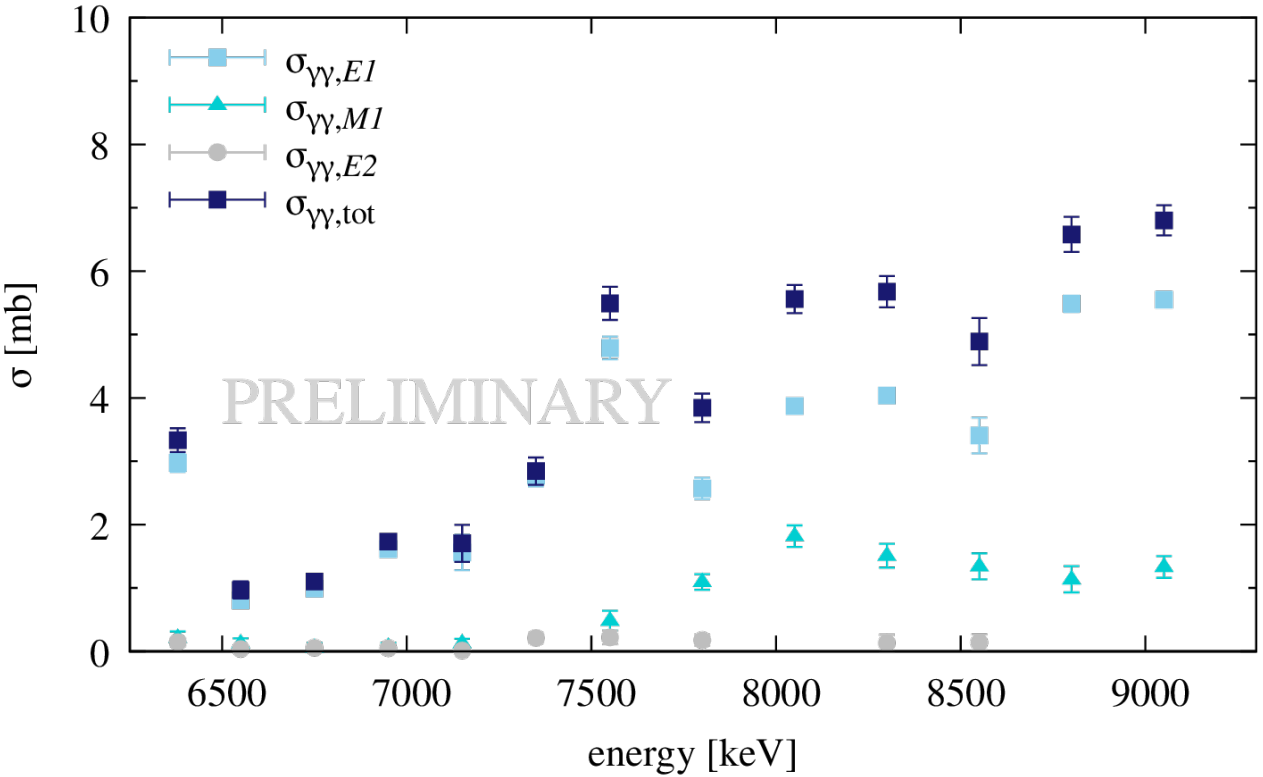
NRF experiments on ^{62}Ni up to S_n already performed at γELBE and HIγS

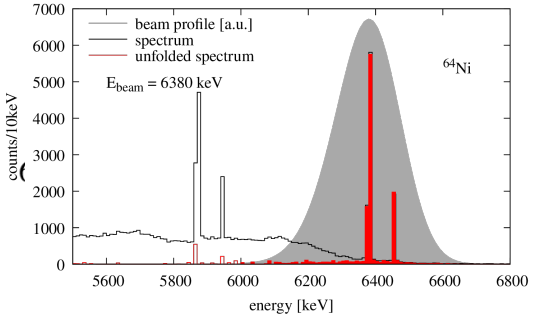
M. Müscher, to be published

no weak elastic decays and no inelastic decays included

Elastic cross section of ^{64}Ni

elastic cross section including unresolved transitions





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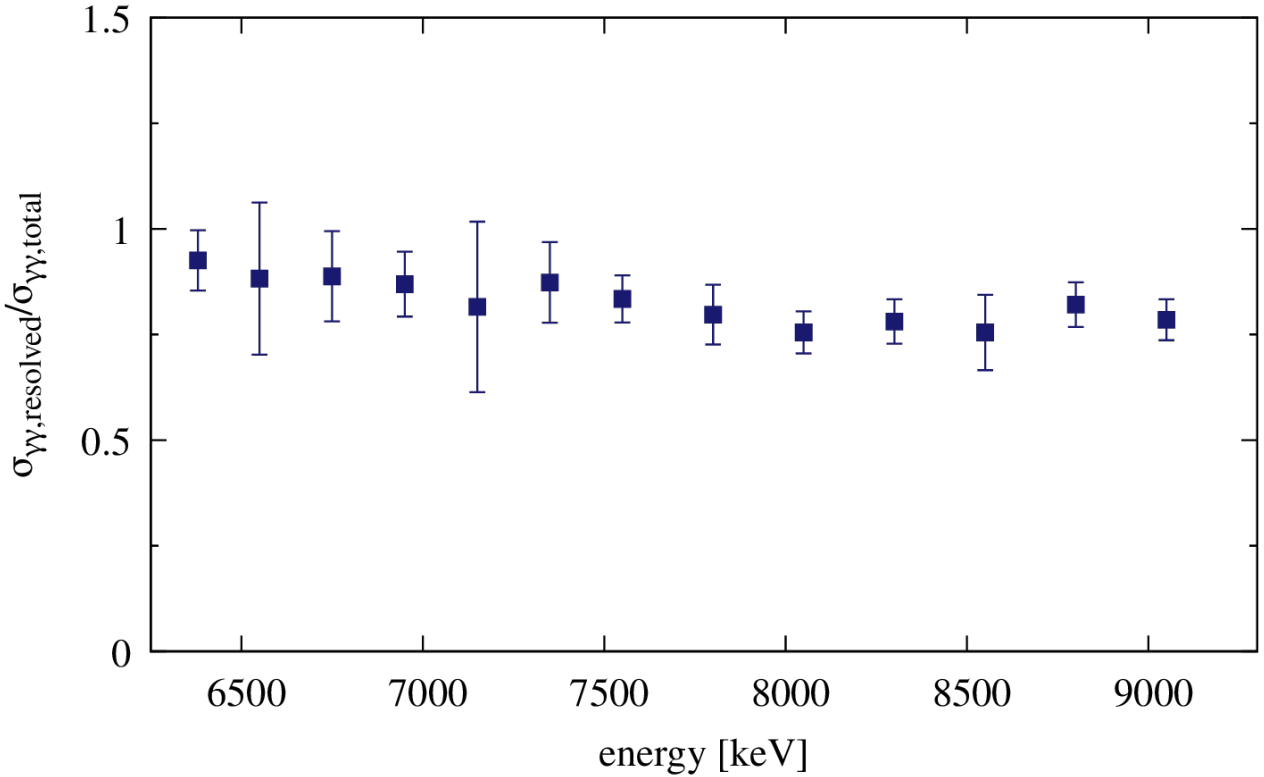
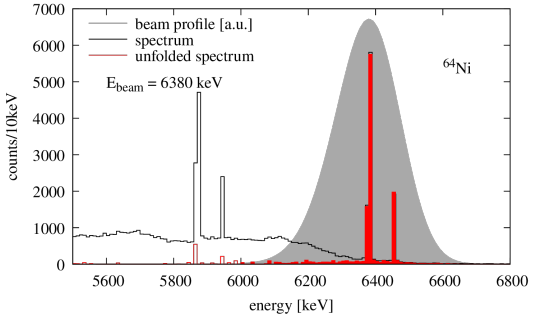
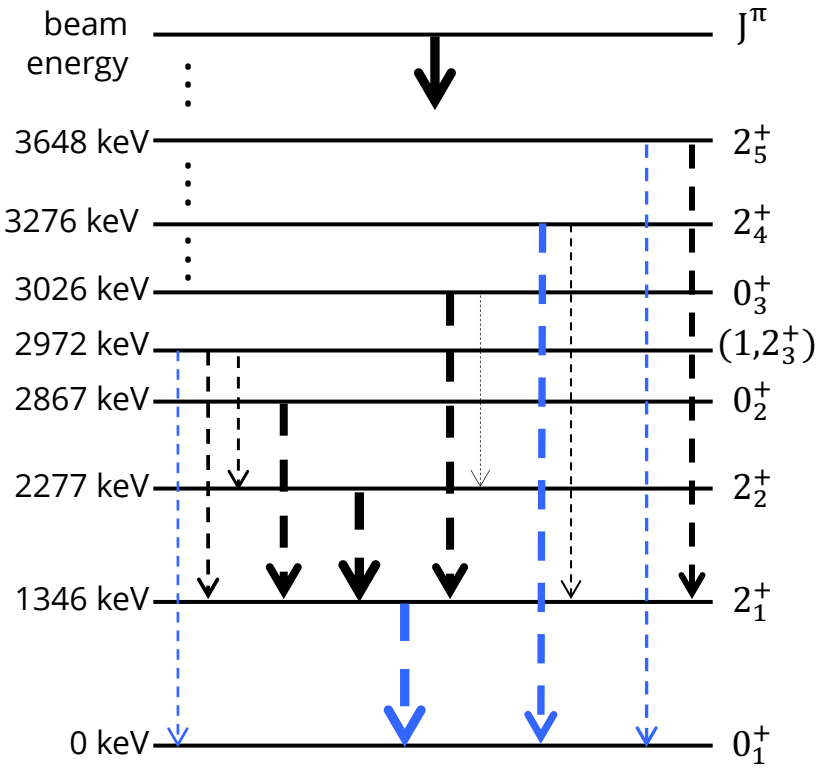




Inelastic cross section of ^{64}Ni

inelastic cross section estimation using first excited states of ^{64}Ni

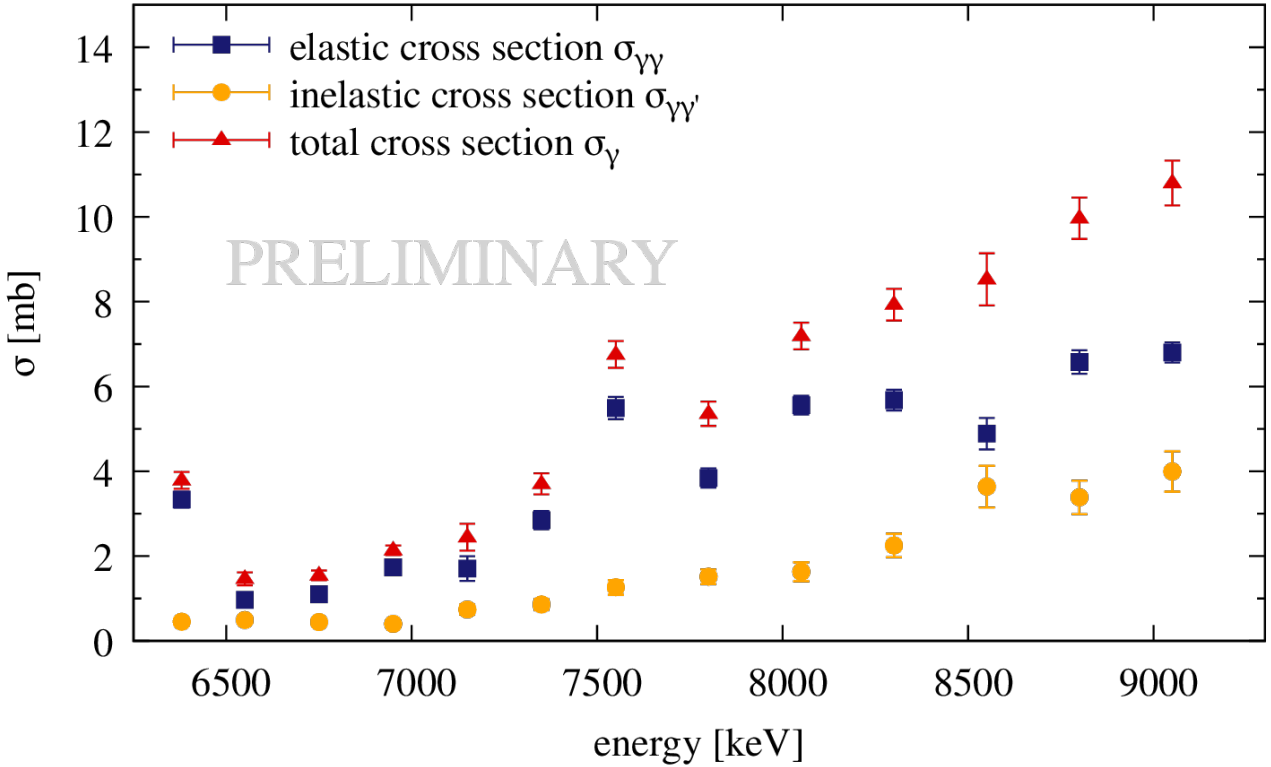
observed ground-state decays of first excited 2^+ states



Total photoabsorption cross section of ^{64}Ni

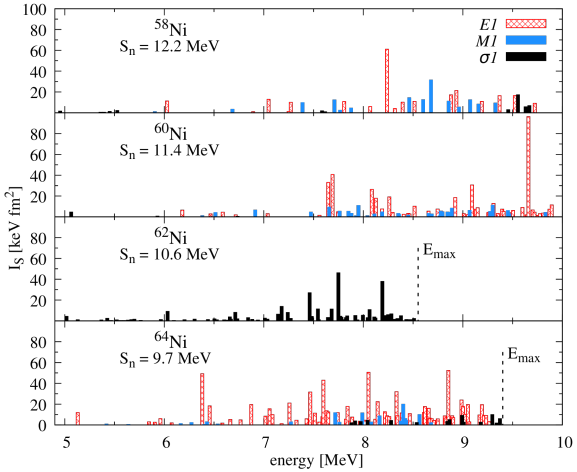
elastic cross section including unresolved transitions

inelastic cross section estimation using first excited states of ^{64}Ni



Summary & outlook

- NRF experiments on all stable, even-even Ni isotopes performed
  - bremsstrahlung
  - Laser-Compton-Backscattering



- state-to-state analysis finished of ^{58,60,64}Ni

  finish state-to-state analysis of ^{62}Ni

- total photoabsorption cross section of ^{64}Ni determined

  need to be done for ^{58,60,62}Ni

→ evolution of low-lying dipole response in Ni isotopes