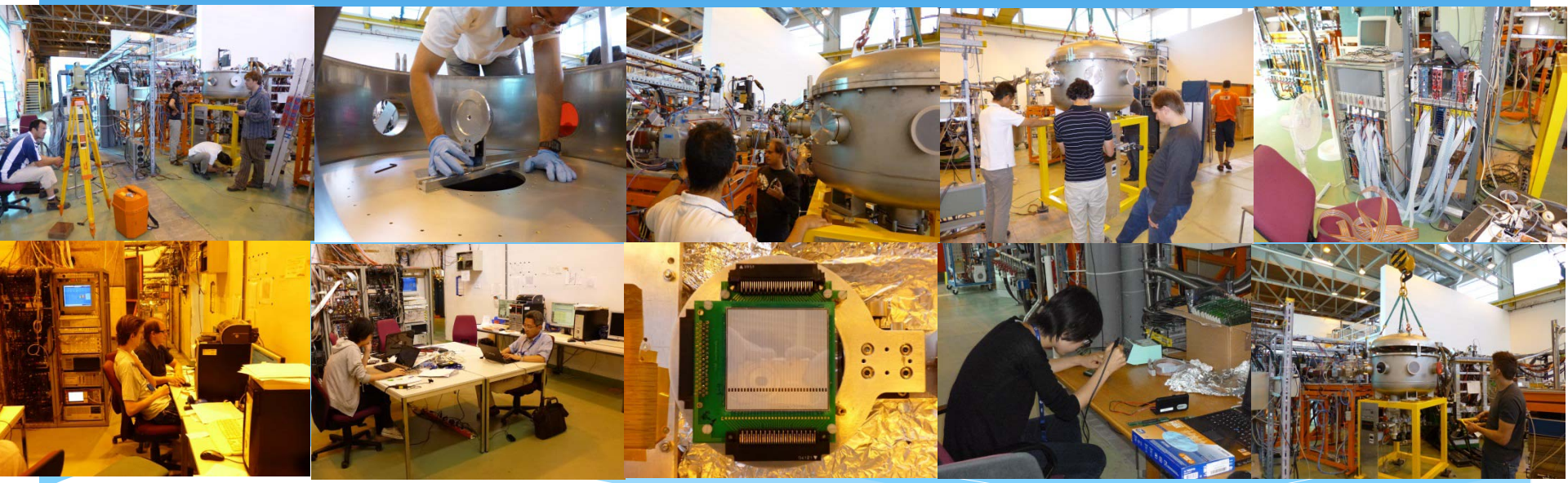
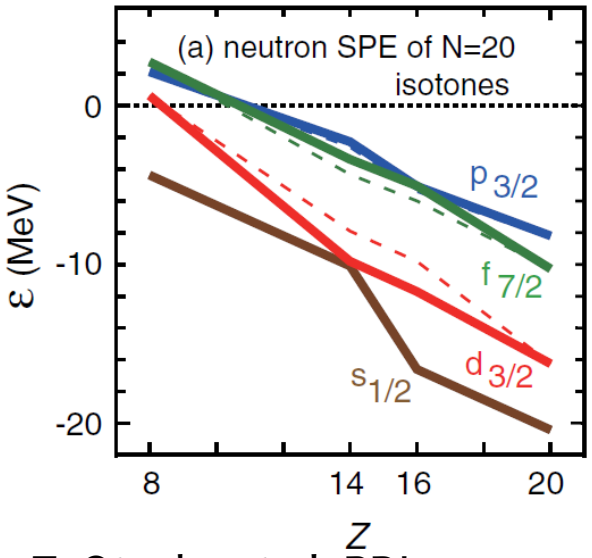
Quenched spectroscopic factors for low-lying positive parity states in ^{31}Mg



Nobu Imai

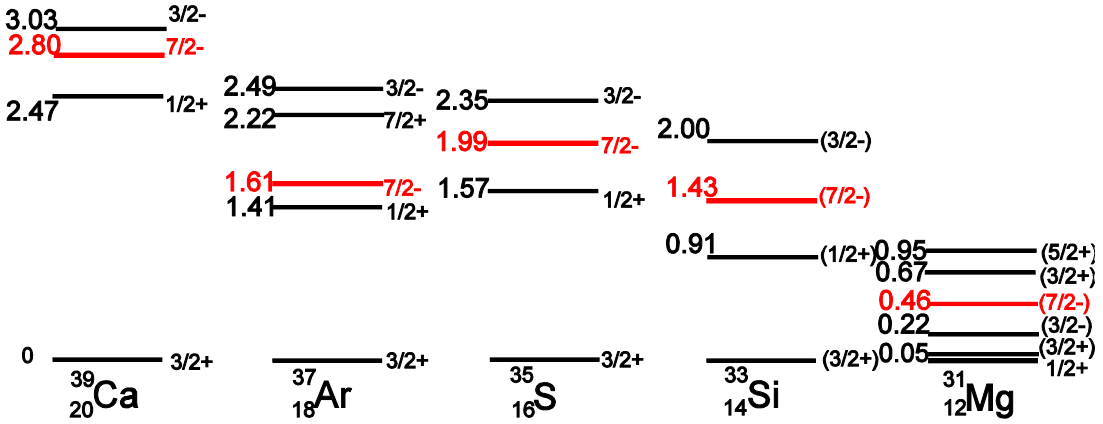
CNS, Univ. of Tokyo

Single particle energies at 'Island of inversion'



T. Otsuka et al, PRL104,012501

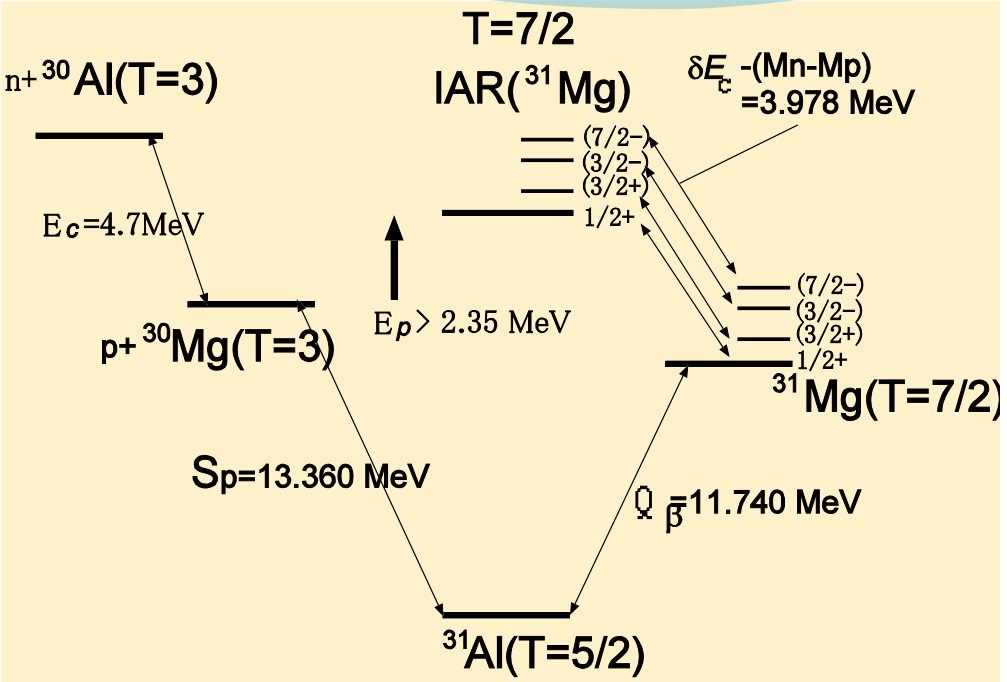
* Energy gap between *pf-sd* orbits.
* Single particle states will be a direct evidence of the shell evolution.



Isobaric Analog Resonances of bound states of ^{31}Mg

- **Same Isospin as the parent state**
- **Tz = T-1/2**
- **Same configuration as the parent state**

Resonance shape
= angular momentum (l)
Resonance width
= total width (Γ_{tot})
Resonance height
= proton width (Γ_p) ~ S^{pp}



Thick target inverse kinematics proton resonance elastic scattering with RIBs

Excitation function of $d\sigma/d\Omega(\theta_{lab.}\sim 0)$

cf.) V.Z. Goldberg, ENAM98

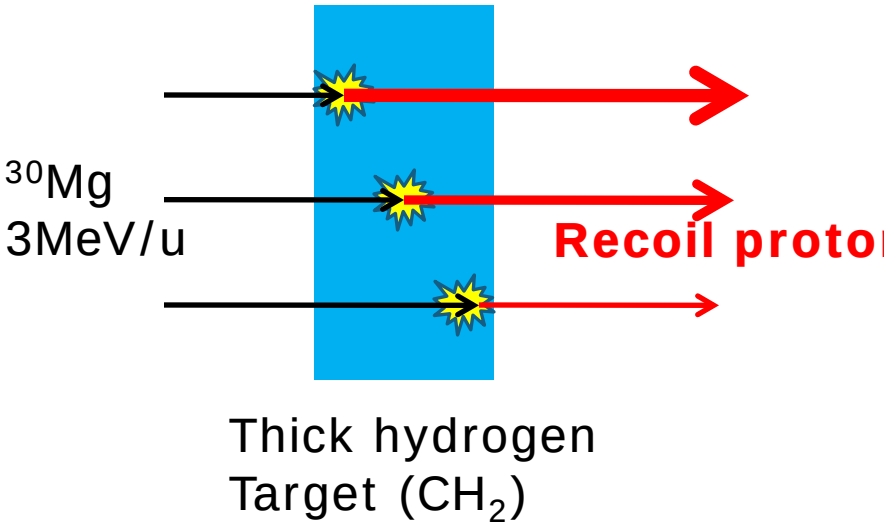
1. High-energy recoil proton

   ~ 4x E_{reso}

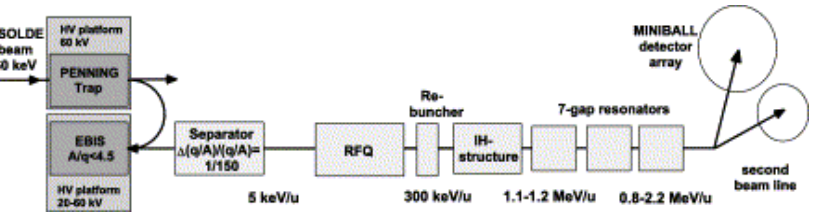
2. One fixed energy

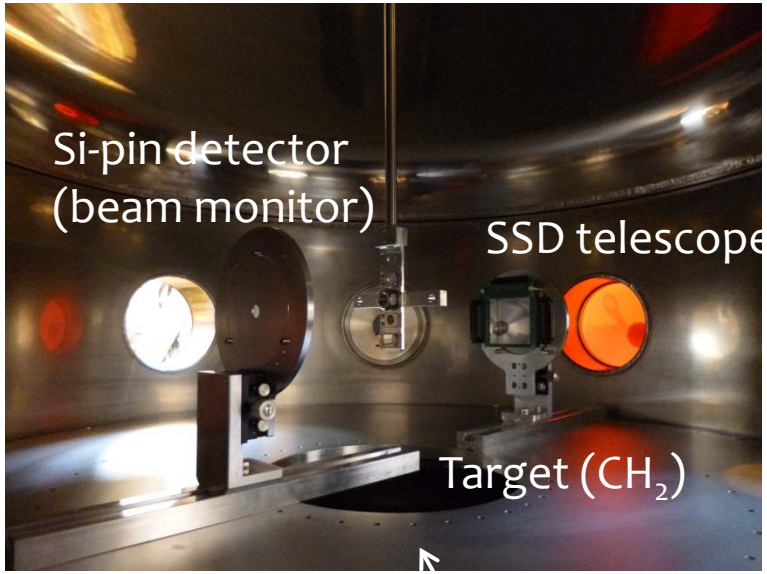
3. Large cross section

   ~ several 10 mb/sr



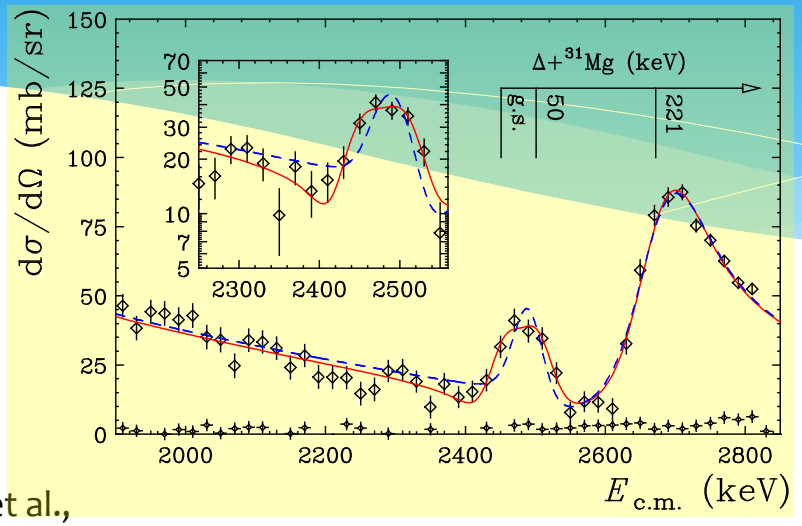
Experimental Setup





- **At the second beam line in REX-ISOLDE**
- **Beam:** $^{30}Mg^{7+}$**: 2.92 MeV/u ~ 10^5 pps**
  ^{26}**Mg :2.88 MeV/u : for calibration**
- **Target**: 5. 6mg/cm^2 thick CH_2
  10.7 mg/cm^2 thick C
- **Detector**: dE-E detector (0.31+ 1.0 mm)
  dE: 32x 32ch doubly sided striped
- **Absolute σ:** off-resonance cross sections

Experimental results



ℓ=0, 1

ℓ=0, 2, 1

submitted. to PRC

N. Imai, M. Mukai, J. Cederkall, et al.,

l	E_R (keV)	Γ_p (keV)	Γ_{tota} (keV)	E^{pp}_{ex} (keV)	E_{ex} (keV) ^{31}Mg
0	2446.8 (49)	8.9 (20)	8.9 (55)	0	0.0
2	2507.3 (64)	2.6 (16)	3.8 (17)	60.5 (80)	51
1	2672.3 (19)	83.3 (32)	111.2 (13)	225.5 (52)	221

$\Gamma_p \sim \Gamma_{tot}$

$E^{pp}_{ex} \sim E_{ex}$

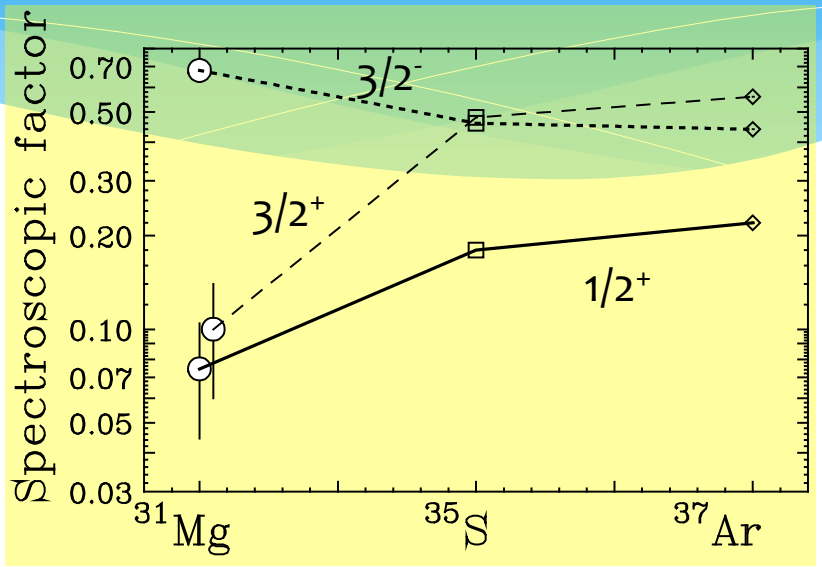
Spectroscopic factors

$$S = \left[\frac{(N-Z-1)\mu r}{P_c^0 e^{-2\zeta_c} \hbar^2 u_n^2(r)} \Gamma_p \right]_{r=a_c}$$

$^{30}\mathrm{Mg(g.s.)} \otimes \nu(2s_{1/2})^{-1} \neq {}^{31}\mathrm{Mg}(1/2^+)$

$^{30}\mathrm{Mg(g.s.)} \otimes \nu(1d_{3/2}) \neq {}^{31}\mathrm{Mg}(3/2^+)$

$^{30}\mathrm{Mg(g.s.)} \otimes \nu(2p_{3/2}) \approx {}^{31}\mathrm{Mg}(3/2^-)$



	S^{pp}	S_{AMD} *1	S_{SM} *2
g.s. (1/2+)	0.07(3)(7)	0.02	0.066
1st (3/2+)	0.10(4)(10)	0.04	0.238
2nd (3/2-)	0.68(4)(20)	0.29	0.399

*1 M. Kimura, private commu.

*2 Y. Utsuno, private commu.

Summary

* Proton resonance elastic scattering on ^{30}Mg was successfully measured with 2.92 MeV/u ^{30}Mg beams.

* IARs of ground and 1st excited states in ^{31}Mg were found to be strongly suppressed.

* Suppressed S^{pp} for 3/2+ state suggests that the core of ^{31}Mg(3/2+) would not $^{30}Mg_{gs}$

Collaborators

* KEK : N.I., Y.X. Watanabe
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* Lund: J. Cederkall, P. Golubev
* CERN: A. Hossein, J. Kurcewicz
* Chalmers: J. Haakan
* Kyusyu-U: T. Teranishi
* CNS, Univ. o Tokyo: D. Kahl