

# Level Structure of $^{69}\text{Ga}$

A. Sharma, Aditi Das, S. Kundu, Pankaj K. Giri,  
S. S. Ghugre, S. Samanta,

K. Katre, I. Bala, R. P. Singh, S. Muralithar, A. Sharma,  
S. Ali, S. S. Tiwary, S. Bhattacharya, S. Rajbanshi, and R. Raut

presented by

Anil Sharma

UGC-DAE CSR, Kolkata Centre  
(collaborators from IUAC, BHU .....)

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the doubly-magic ( $Z, N = 28$ )  $^{56}\text{Ni}$  core & around  
first (lowest) closure emerging from inclusion of l.s coupling  
in the shell model Hamiltonian

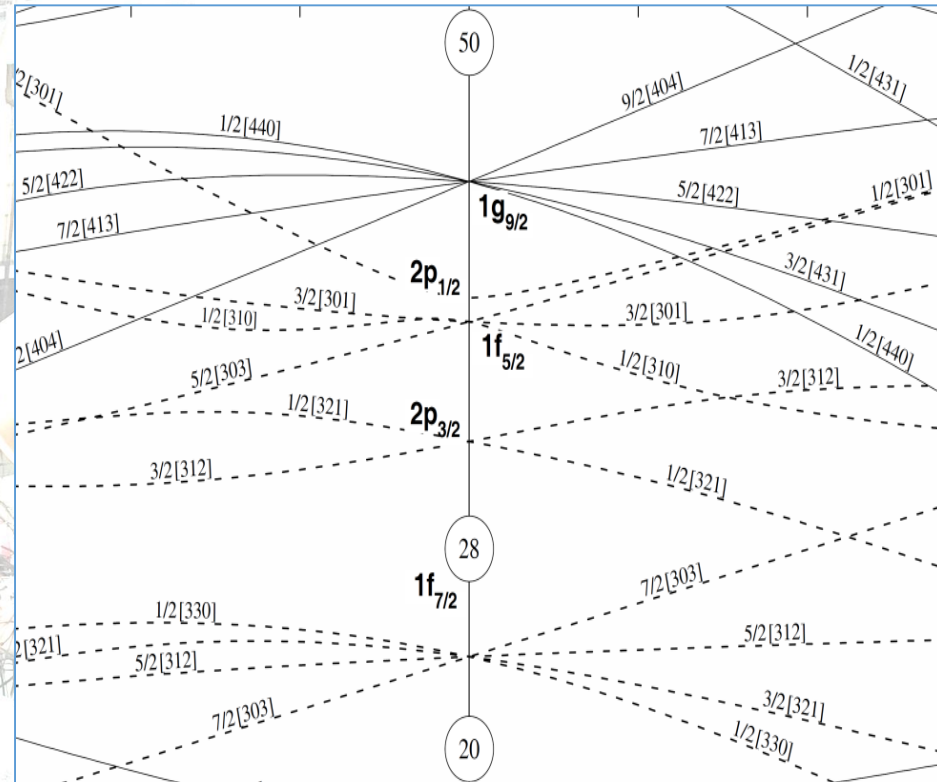
testing grounds for shell  
model calculations

evolution of shell closure

observation of core-broken  
states

development of collectivity

other excitation phenomena  
(shears mechanism)



very recent studies on Mn ( $Z = 25$ ), Fe ( $Z = 26$ ), Co ( $Z = 27$ ),  
Ni ( $Z = 28$ ), Cu ( $Z = 29$ ), Zn ( $Z = 30$ ) .....

[UNC/TUNL, FSU, Peking, VECC, VB, IUAC, UGC-DAE CSR ...]

# Spectroscopy around the Doubly Magic $^{56}\text{Ni}$ Core @ UGC-DAE CSR, Kolkata Centre

experiment at TIFR using  $^7\text{Li}+^{59}\text{Co}$  @  $E_{\text{lab.}} = 22\text{-}24\text{ MeV}$ ;  
11 Compton suppressed HPGe clover detector;  
5.2 mg/cm<sup>2</sup>  $^{59}\text{Co}$  (mono-isotopic) target on 4 mg/cm<sup>2</sup> Ta

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## Single-particle excitations in the level structure of $^{64}\text{Cu}$

S. Samanta, S. Das, R. Bhattacharjee, S. Chatterjee, R. Raut,<sup>\*</sup> and S. S. Ghugre  
UGC-DAE Consortium for Scientific Research, Kolkata Centre, Kolkata 700098, India

A. K. Sinha

UGC-DAE Consortium for Scientific Research, University Campus, Khandwa Road, Indore 452017, India

U. Garg

Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556, USA

Neelam

Department of Physics and Astrophysics, University of Delhi, New Delhi 110007, India

N. Kumar

Amity Institute of Nuclear Science and Technology, Amity University, Noida 201303, India

P. Jones

Department of Subatomic Physics, iThemba Labs, Somerset West 7129, South Africa

Md. Sazedur R. Laskar, F. S. Babra, S. Biswas, S. Saha, P. Singh, and R. Palit  
Tata Institute of Fundamental Research, Mumbai 400005, India

PHYSICAL REVIEW C **99**, 014315 (2019)

## Single particle configurations in $^{61}\text{Ni}$

S. Samanta, S. Das, R. Bhattacharjee, S. Chatterjee, R. Raut,<sup>\*</sup> and S. S. Ghugre  
UGC-DAE Consortium for Scientific Research, Kolkata Centre, Kolkata 700098, India

A. K. Sinha

UGC-DAE Consortium for Scientific Research, University Campus, Khandwa Road, Indore 452017, India

U. Garg

Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556, USA

Neelam

Department of Physics and Astrophysics, University of Delhi, New Delhi 110007, India


N. Kumar

Government Degree College, Dhallara, District Kangra, Himachal Pradesh 177103, India

P. Jones

Department of Subatomic Physics, iThemba LABS, Somerset West 7129, South Africa

Md. S. R. Laskar, F. S. Babra, S. Biswas, S. Saha, P. Singh, and R. Palit  
Tata Institute of Fundamental Research, Mumbai 400005, India

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## Single-particle configurations of low- and medium-spin states in $^{63}\text{Cu}$

S. Chatterjee, B. Mondal, S. Samanta, S. Das, R. Raut,<sup>\*</sup> and S. S. Ghugre  
UGC-DAE Consortium for Scientific Research, Kolkata Centre, Kolkata 700098, India

P. C. Srivastava

Department of Physics, Indian Institute of Technology, Roorkee, Roorkee 247667, India

A. K. Sinha

UGC-DAE Consortium for Scientific Research, University Campus, Khandwa Road, Indore 452017, India

U. Garg

Department of Physics and Astronomy, University of Notre Dame, Notre Dame, Indiana 46556, USA

Neelam

Department of Physics and Astrophysics, University of Delhi, New Delhi 110007, India

Naveen Kumar

Government College, Haripur (Guler), District Kangra, Himachal Pradesh 176028, India

P. Jones

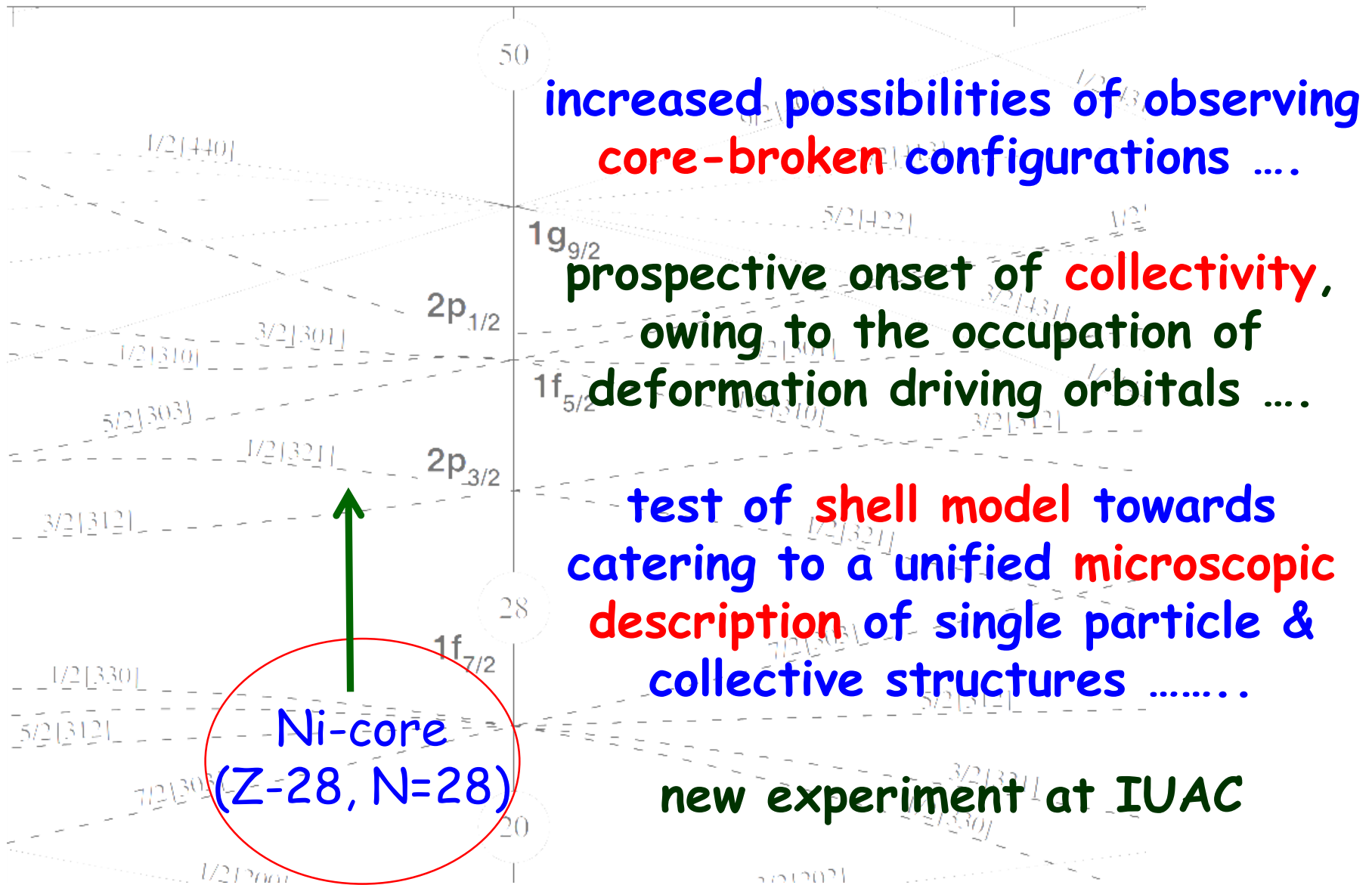
Department of Subatomic Physics, iThemba LABS, Somerset West 7129, South Africa

Md. S. R. Laskar, F. S. Babra, S. Biswas, S. Saha, P. Singh, and R. Palit  
Tata Institute of Fundamental Research, Mumbai 400005, India

new transitions; interpretation from large basis shell model  
calculations with fp<sub>g</sub> model space;  $f_{7/2}$  excited  
configurations probed for  $^{63}\text{Cu}$ ; identification of  $g_{9/2}$   
occupancy ..... without any evidence of collectivity  
higher excitations, heavier systems ?



# Nuclei with Few Nucleons Outside $^{56}\text{Ni}$ Core



our experiment at INGA @ IUAC

$^{59}\text{Co}(^{13}\text{C}, xnypz\alpha)\text{As, Ge, Ga}$  @  $E_{\text{lab.}} = 45, 50 \text{ MeV}$   
[ $V_B \sim 23 \text{ MeV}$ ]

target  $\sim 5.2 \text{ mg/cm}^2$  (99%) thick  $^{59}\text{Co}$  on  $4 \text{ mg/cm}^2$  Ta backing  
(fabricated at TIFR target laboratory)

beam energy optimized following an excitation function  
measurement;

INGA consisting of 16 Compton suppressed Clover detectors  
 $148^\circ, 123^\circ, 90^\circ, 57^\circ, 32^\circ$

triggered at  $\geq 2$ -fold multiplicity  
events rate  $\sim 5\text{-}6 \text{ kHz}$ .

data sorted using LAMPS (BARC) & SPRINGZ (developed at  
UGC-DAE CSR, KC) & analyzed using CUBIX, RADWARE

# Literature on $^{69}\text{Ga}$

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## Excited states in $^{69}\text{Ga}$

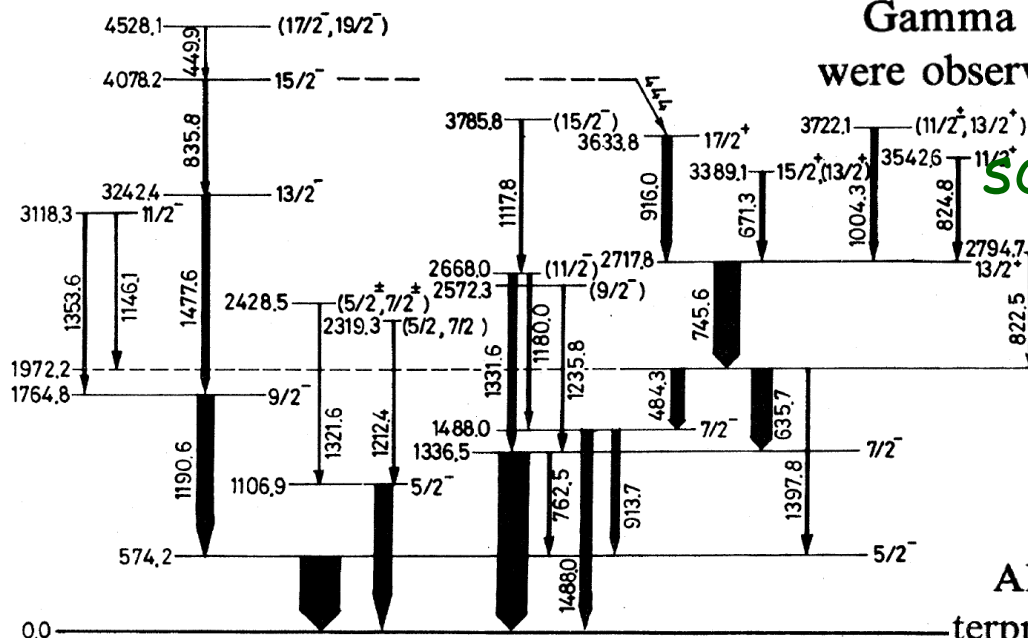
P. Bakoyeorgos and T. Paradellis

Tandem Accelerator Laboratory, Nuclear Research Center Demokritos,  
Aghia Paraskevi, Athens, Greece

P. A. Assimakopoulos

The University of Ioannina, Ioannina, Greece

Gamma rays resulting from the bombardment  
were observed with the aid of two Ge(Li) detectors



shell model interpretation

scope of expanding the level  
scheme, following high  
resolution gamma-ray  
spectroscopy with large  
detector array

Although the gross structure of  $^{69}\text{Ga}$  may be interpreted in terms of particle-core coupling of the form  $\{g_{9/2} \times J\}_{I+}$  and  $\{f_{5/2} \times J\}_{I-}$  with  $J=0^+, 2^+, 4^+, 6^+$ , the energy separation between succes-

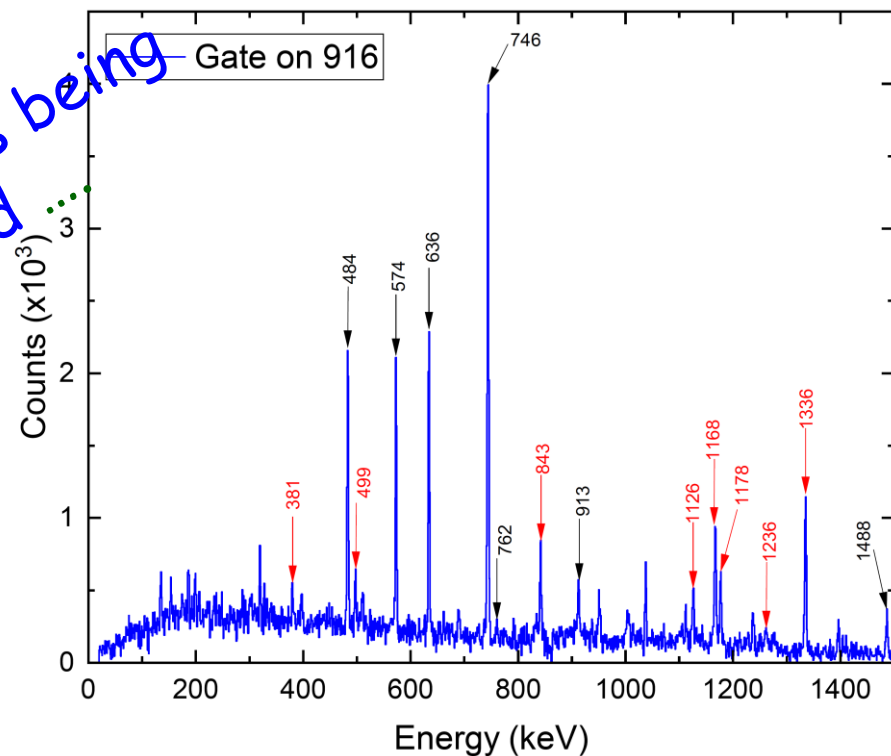
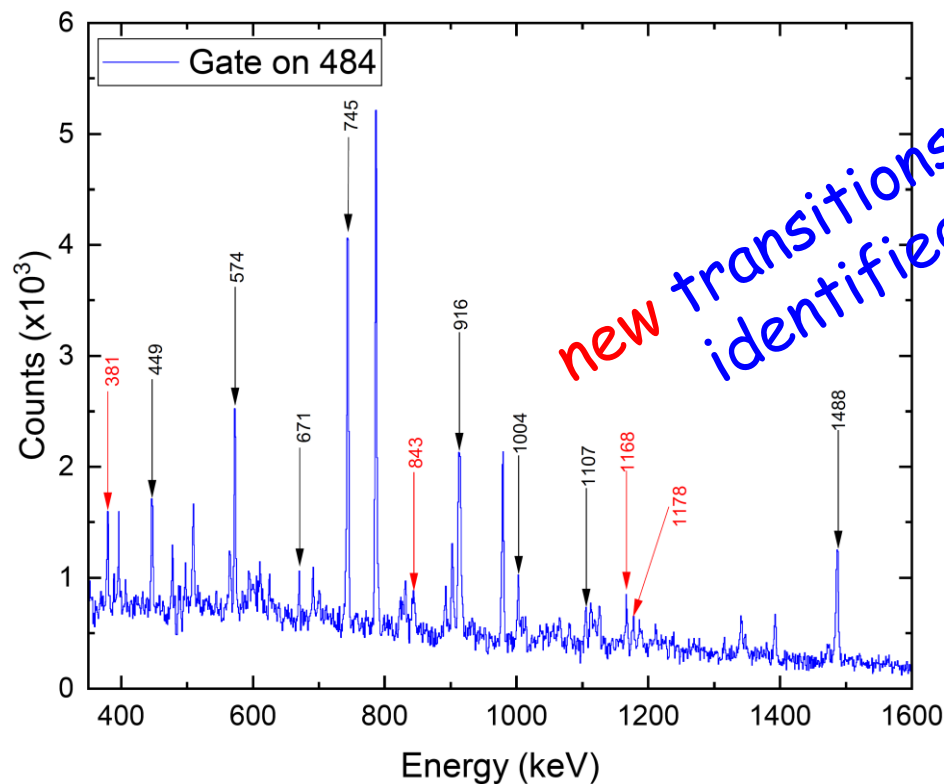
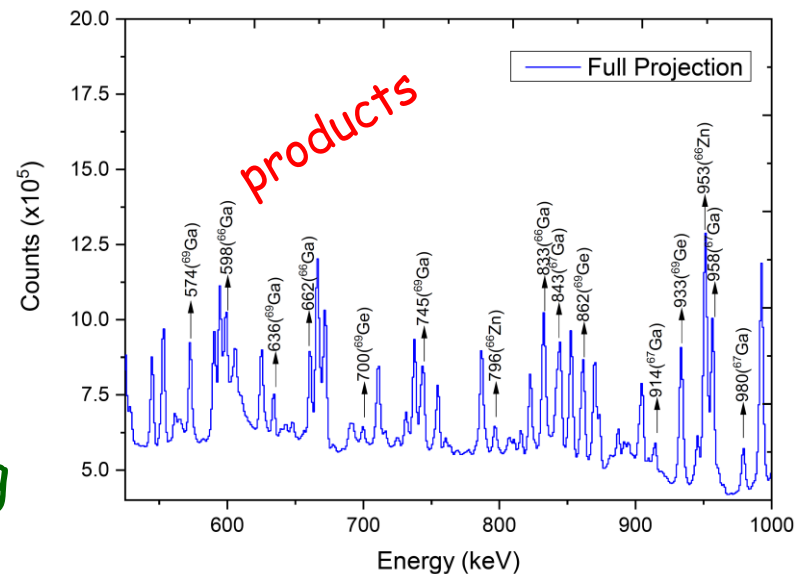
nucleus of interest  
 $Z=31, N=38$

earlier studies using few  
detectors .....  
spectroscopy & lifetime  
measurements

# Data Analysis

standard practices of gamma-ray  
spectroscopy based on coincidence  
measurements

gamma-gamma symmetric &  
asymmetric matrices for extracting  
the level structure information

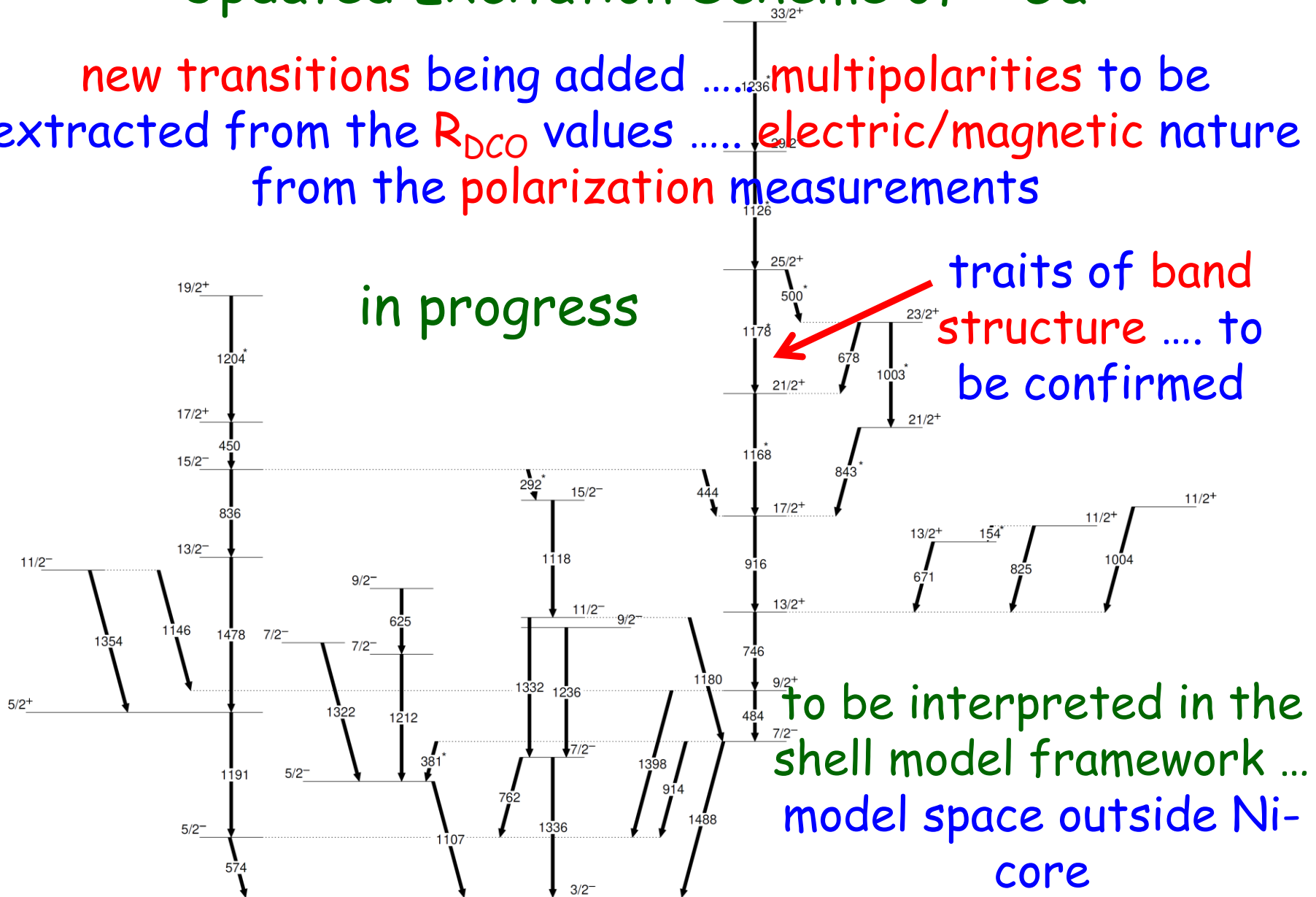


# Updated Excitation Scheme of $^{69}\text{Ga}$

new transitions being added .... multipolarities to be  
extracted from the  $R_{\text{DCO}}$  values .... electric/magnetic nature  
from the polarization measurements

in progress

traits of band  
structure ... to  
be confirmed



to be interpreted in the  
shell model framework ...  
model space outside Ni-  
core

thank you very much