

## **Dr Ashok Kumar**

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**Date of birth:** 30.07.1964  
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**Present Status:** Assistant Professor  
Department of Physics,  
Panjab University, Chandigarh, India.

**Post Doctoral Fellow (From Oct. 2003- Dec. 2004)**  
**Department of Physics & Astronomy**  
**University of Kentucky**  
**Lexington, Kentucky, USA**

### **Following are the areas of my Research Interest:**

#### **(i) Study of Lifetimes of The High Spin states by RDM and DSAM:**

At present our group is engaged in lifetime measurements and high spin structure of excited states in the two mass regions, Xe-Ba-Ce and A=170-190. For this purpose, we are using the 'plunger' device and INGA setup (19 Clovers at present) at Inter University Accelerator Centre (IUAC) New Delhi and Tata Institute of Fundamental Research (TIFR) using 15UD pelletron. Lifetimes are extracted using the computer codes LIFETIME and LINESHAPE by J. C. Wells for RDM and DSAM measurements.

(ii) ION BEAM Analysis: We have small accelerator in our Department which is being used for trace element analysis of aerosol, soil and biological samples.

#### **(iii) Study of PreScission and PostScission Charged Particle Emission in Heavy Ion Reactions:**

During the course of the fission process, the nuclear system undergoes drastic shape changes. It is a dynamical process for which the nucleus needs time to deform up to scission. Neutrons and charged-particle (mainly proton and  $\alpha$ -particle) emission take place from various stages:

- (i) From the fissioning compound nucleus (prescission)
- (ii) from the accelerated fission fragments (postsission)

Prescission and PostScission neutron and charged-particle emission spectra and multiplicities provide important information on the statistical and dynamical aspects of

the fusion-fission process. It is observed that  $\alpha$ -particles are also emitted very near the neck region in the fission process just before scission. This part of pre-scission  $\alpha$  particles emitted near the neck region is termed as near-scission emission (NSE). The study of the dynamics of the shape evolution, and in particular the effect of dissipation, is crucial to our understanding the one-body or two-body nature of the nuclear viscosity. Nuclear viscosity has the effect of slowing down the fission process leading to fission lifetimes of the order of  $10\text{--}100 \times 10^{-21}$  s.

#### **(iv) Study of Dynamical and Entrance Channel Effects using Light Particles**

In these experiments, we are using  $\Delta E$ -E telescopes (Silicon surface barrier detectors). For the detection of Neutrons we are using the organic liquid scintillator (NE213) and time-of-flight technique to measure the energies of evaporated neutrons with Pulse Shape Discriminators (PSD).

#### **(v) Neutrino Physics**

Neutrinos are among the most abundant particles in the universe, a billion times more abundant than the particles that make up stars, planets and people. Each second, a trillion neutrinos from the sun and other celestial objects pass through your body.

Following are the questions which need answers:

1. Can we observe the oscillation of muon neutrinos to electron neutrinos?
2. What is the ordering of the neutrino masses?
3. What is the symmetry between matter and antimatter?

## Research Publications in Referred International Journals

1. High spin structure in  $^{130, 131}\text{Ba}$   
N. Kaur, **A. Kumar**, G. Mukherjee, A. Singh, S. Kumar, R. Kaur, V. Singh, B.R. Behera, K.P. Singh, G. Singh, H.P. Sharma, S. Kumar, M. Raju, P.V.M. Rao, S. Muralithar, R.P. Singh, R. Kumar, N. Madhvan, R.K. Bhowmik  
**Eur. Phys. A 50, 5(2014)**
2. Anomalous deviations from statistical evaporation spectra for the decay of the  $^{73}\text{Br}$  and  $^{77}\text{Rb}$  compound systems  
M. Kaur, B.R. Behera, G. Singh, V. Singh, R. Sandal, **A. Kumar**, H. Singh, G. Singh, K.P. Singh, N. Madhvan, S. Nath, A. Jhingan, J. Gehlot, K.S. Golda, P. Sugathan, D. Siwal, S. Kalkal, E. Prasad, S. Appannababu  
**Phys. Rev. C 89, 034621 (2014)**
3. Measurement of evaporation residue excitation functions for the  $^{19}\text{F} + ^{194, 196, 198}\text{Pt}$  reactions  
V. Singh, B. R. Behera, M. Kaur, **A. Kumar**, K.P. Singh, N. Madhvan, S. Nath, J. Gehlot, G. Mohanto, A. Jhingan, Ish Mukul, T. Varughese, J. Sahdukahn, S. Pal, S. Goyal, A. Saxena, S. Santra, S. Kailas  
**Phys. Rev. C 89, 024609 (2014)**
4. Neutron multiplicity measurements for  $^{19}\text{F} + ^{194, 196, 198}\text{Pt}$  systems to investigate the effect of shell closure on nuclear dissipation  
V. Singh, B. R. Behera, M. Kaur, **A. Kumar**, P. Sugathan, K.S. Golda, A. Jhingan, M. B. Chatterjee, R.K. Bhowmik, D. Siwal, S. Goyal, J. Sadhukhan, S. Pal, A. Saxena, S. Santa, S. Kailas  
**Phys. Rev. C 87, 064601 (2013)**
5. Effect of N/Z in pre-scission neutron multiplicity for  $^{16, 18}\text{O} + ^{194, 198}\text{Pt}$  systems  
Rohit Sandal, B. R. Behera, Varinderjit Singh, Maninder Kaur, **A. Kumar**, G. Singh, and K. P. Singh, P. Sugathan, A. Jhingan, K. S. Golda, M. B. Chatterjee, and R. K. Bhowmik, Sunil Kalkal, D. Siwal, S. Goyal, and S. Mandal, E. Prasad, K. Mahata and A. Saxena, Jhilam Sadhukhan, Santanu Pal  
**Phys. Rev. C 87, 014604 (2013)**
6. Investigation of major and Trace elements in some medicinal Plants using PIXE  
Rajbir Kaur, **A. Kumar**, Navneet Kaur, B. P. Mohanty, M. Oswal, K P Singh, B R Behera, Gulzar Singh, Richa Puri, Shikha Sharma, Sanjiv Kumar, Pritty Rao, and S. Vikramkumar.  
**International Journal of PIXE 22, 113 (2012).**
7. Trace elemental analysis of Aerosamples Using PIXE technique  
Mumtaz Oswal, Rajbir Kaur, **A. Kumar**, K. P. Singh, Sunil Kumar, B. P. Mohanty  
**International Journal of PIXE Vol. 22, No. C 03n04, pp 271-285 (2012)**
8. Elemental Analysis of Ground Water Using PIXE and PIGE Techniques

Rajbir Kaur, **A. Kumar**, B. P. Mohanty, Mumtaz Oswal, Navneet Kaur,  
K. P. Singh, B. R. Behera, Gulzar Singh, Sanjiv Kumar, Pritty Rao, S. Vikramkumar  
**International Journal of PIXE , Vol. 22, No. 03n04, pp 259-269 (2012)**

**9. New decay pattern of negative-parity states at N=90**

A. Chakraborty, F. M. Prados-Estévez, S. N. Choudry, B. P. Crider, P. E. Garrett, W. D. Kulp,  
**A. Kumar**, M. T. McEllistrem, S. Mukhopadhyay, M. G. Mynk, J. N. Orce, E. E. Peters, J. L.  
Wood, and S. W. Yates

**Phys. Rev. C C 86, 064314 (2012)**

**10. Theoretical Interpretation of Systematics of Effective Single Particle Level Densities**

from (n, p) Reactions at 14.8 MeV Energies

H. S. Hans, Gulzar Singh, **A. Kumar**, K. P. Singh, B. R. Behera and Sudip Ghosh

**Phys. Rev C 85, 054614(2012).**

**11. Search for an effect of shell closure on nuclear dissipation via a neutron multiplicity measurements.**

V. Singh, B.R. Behera, M. Kaur, P. Sughatan, K.S. Golda, A. Jhingan, J. Sadhukhan, D. Siwal, S.  
Goyal, S. Santra, **A. Kumar**, R. K. Bhowmik, M.B. Chatterjee, A. Saxena. S. Pal & S. Kailash.

**Phys. Rev. C 86, 014609 (2012)**

**12. Main Injector particle production experiment at Fermilab**

Sonam Mahajan, **A. Kumar**, R. Raja

**Parmana Journal of Physics, Volume 79, Issue 5, pp 1243-1246 (2012)**

**13. Trace elements of soil samples from mining area**

Mumtaz Oswal, Harneet Bedi, M. Hajivaliei, **A. Kumar** and K. P. Singh

**Nuclear Instruments & Methods B268, 2138(2010).**

**14. Identification of Mixed-Symmetry States in an Odd-Mass Nearly Spherical Nucleus**

J. Orce. et al.

**Phys. Rev. Lett. 97, 062504 (2006)**

**15. Octupole and hexadecapole bands in  $^{152}\text{Sm}$**

**P. E. Garrett et. al.** J.Phys.(London) G31, S1855 (2005)

**16. Heterogeneous vibrations in  $^{112}\text{Sn}$**

**A.Kumar**, J. N. Orce, S. R. Leshner, C.J. McKay, M. T. McEllistrem, S. W Yates

**Phys.Rev. C 72, 034313 (2005)**

**17. Polarization measurement and  $\gamma$ -ray spectroscopy of  $^{122}\text{Cs}$**

R. Kumar. **A. Kumar**, S. K. Chamoli, K. Singh, M. Sharma, D. Mehta, N. Singh, S.S. Ghugre, N.S.

Pattabhiraman, L. Chaturvedi, P.K. Joshi, H.C. Jain, Z. Naik, C. R. Praharaj, I.M. Govil.

**Phys.Rev. C 72, 044319 (2005)**

**18. Lifetime measurements and low-lying structure in  $^{112}\text{Sn}$**

**A. Kumar**, J. N. Orce, S. R. Leshner, C.J. McKay, M. T. McEllistrem, S. W Yates

**Eur.Phys.J. A 25, Supplement 1, 443 (2005)**

19. Shape coexistence and lifetime measurement in  $^{187}\text{Tl}$  nucleus  
S. K. Chamoli, P. Joshi, **A. Kumar**, R. Kumar, R. P. Singh, S. Muralithar, R. K. Bhowmik and I. M. Govil  
**Phys. Rev. C 71, 054324 (2005).**
20. Anomalous behavior of the level density parameter in neutron and charges particle evaporation.  
Ajay Kumar, **A. Kumar**, G. Singh, Herdev Singh, R. P. Singh, Rakesh Kumar, K. S. Golda, S. K. Datta and I. M. Govil:  
**Phys. Rev. C 70 044607 (2004).**
21. Dynamical effects in the heavy-ion fusion reactions of the compound nucleus  $^{80}\text{Sr}^*$  via charged particle evaporation  
J. Kaur, Ajay Kumar, **A. Kumar**, G. Singh, S. K. Datta, and I. M. Govil.  
**Phys. Rev. C70 017601, (2004)**
22. Deformation effects in  $^{185}\text{Au}$   
P. Joshi, **A. Kumar**, I. M. Govil, R. P. Singh, S. Muralihar, G. Mukherjee, R. K. Bhowmik and U. Garg  
**Phys. Rev. C69 044304 (2004).**
23. Deformation studies at high spin in  $\gamma$ -soft  $^{179}\text{Re}$  Nucleus  
S. K. Chamoli, P. Joshi, **A. Kumar**, R. P. Singh, S. Muralithar, R. K. Bhowmik, Z. Naik, C. R. Pragaraj and I. M. Govil:  
**Phys. Rev C69 034310 (2004).**
24. Search for entrance channel effects in heavy ion induced fusion reactions via neutron evaporation.  
Ajay Kumar, **A. Kumar**, B. K. Yogi, Rakesh kumar, S. K. Datta, M. B. Mukherjee and I. M. Govil:  
**Phys. Rev. C68 034603 (2003).**
25. Test of deformation driving effects in  $^{179}\text{Re}$   
S. K. Chamoli, P. Joshi, **A. Kumar**, R.P.Singh, L. Chaturvedi & I. M. Govil  
**Nuclear Physics A722563c-567c (2003).**
26. Recoil Distance lifetime measurements in  $^{118}\text{Xe}$ .  
I. M. Govil, **A. Kumar**, H. Iyer, P. Joshi, S. K. Chamoli, Rakesh Kumar, R. P. Singh **Phys. Rev. C 66, 064318-1 (2002)**
27. Configuration dependence of deformation in  $^{183}\text{Au}$   
P. Joshi, **A. Kumar**, G. Mukherjee, R. P. Singh, S. Muralithar, U. Garg, R. K. Bhowmik and I. M. Govil  
**Phys. Rev. C. 66,044306-1 ,(2002)**
28. Search for entrance channel effects in the heavy ion induced fusion reaction through the compound system  $^{79}\text{Rb}$   
J. Kaur, I. M. Govil, G. Singh, Ajay Kumar, **A. Kumar**, B. R. Behera and S. K. Datta  
**Phys. Rev. C 66, 034601-1(2002).**
29. Configuration dependent shapes in the  $^{177}\text{Re}$ .

S. K. Chamoli, P. Joshi, **A. Kumar**, R. P. Singh, S. Muralithar, R. K. Bhowmik, Z. Naik, C. R. Praharaj and I. M. Govil:

**Phys. Rev C 66, 024307-1 (2002).**

**30.** Inelastic scattering of 28.0 MeV proton on  $^{56}\text{Fe}$

**A. Kumar**, D. K. Avasthi, A. Tripathi, S. K. Datta and I. M. Govil

**Phys. Rev. C. 65 014305-1(2002).**

**31.** The deformation driving property of the  $h_{9/2}$  configuration in  $^{173}\text{Ta}$ : P. Joshi, G. Mukharjee,

**A. Kumar**, R. P. Singh, S. K. Chamoli, S. Muralithar, C. R. Praharaj, U. Garg, R. K. Bhowmik and I. M. Govil

**Phys. Rev. C 60 034311-1(2001)**

**32.** Neutron pick-up strength from  $^{56}\text{Fe}(p,d)^{55}\text{Fe}$  at 28.0 MeV

**A. Kumar**, D. K. Avasthi, A. Tripathi, K. Datta and I. M. Govil.

**Acta Physica Polonica B Vol. 32 (2001)**

**33** Search for entrance channel effects in the decay of compound nucleus

I. M. Govil, R. Singh, **A. Kumar**, S. K. Datta, and S. K. Kataria

**Nuclear Phys. A674 377(2000).**

**34** K- and L- X ray production cross-section and intensity ratios of rare earth Elements for proton impact in the energy range 20-25 MeV

M. Hajiveliei, S. puri, M.L. Garg, D. Mehta, A. Kumar, S. K. Chamoli, D.K. Avasthi, A. Mandal, T.K. Nandi, K.P. Singh, N. Singh, I.M. Govil

**NIM B 160, 203 (2000).**

**35.** Dynamical effects in the decay of the compound nucleus:

I. M. Govil, R. Singh, **A. Kumar**, Ajay Kumar, G. Singh, S. K. Kataria and S. K. Datta

**Phys. Rev. C62,064606,(2000).**

**36.** Deformation driving property of  $h_{9/2}$  in  $^{171}\text{Ta}$

P. Joshi, G. Mukharjee, **A. Kumar**, R. P. Singh, S. Muralithar, S. C. Pancholi, C. R. Praharaj, U. Garg, R. K. Bhowmik, and I. M. Govil

**Phys. Rev. C. 60 034311-1(1999).**

**37** Recoil distance lifetime measurements in  $^{122,124}\text{Xe}$

I. M. Govil, **A. Kumar**, H. Iyer, H. Li, U. Garg, S. S. Ghugre, T. Johnson, R. Kaczarowski, B. Kharraja, S. Naguleswaran and J. C Walpe:

**Phys. Rev. C 57, no.1 632(1998).**

**38** Alpha particle emission as a probe of dynamical deformation.

I.M. Govil, R.Singh, **A. Kumar**, J.Kaur, A.K. Sinha, N. Madhvan, D.O. Kataria, P. Sugathan, S.K. Kataria, Bency John and G.V. Ravi Prasad:

**Phys. Rev. C 57 1269 (1998).**

**39.** Angular momentum induced deformation of  $^{55}\text{Co}$  at 84 MeV excitation.

D. K. Agnihotri, **A. Kumar**, K.C.Jain, G. Singh, D. Kabiraj, D. K. Avasthi, and I. M. Govil:

**Phys. Lett. B307, 283 (1993).**