Professor Satya Pal Puri, Mössbauer Spectroscopist.

On 30th January, 1930, just a day before the first birthday of Nobel laureate Rudolf L. Mössbauer, Professor Satya Pal Puri was born in a small family in a village in Distt. Hoshiarpur, Punjab (India). His parents, especially his mother, desired him to devote himself fervently to his education. With his introspective bent of mind and incisive attitude, he will assess the outcome of any step before venturing it. It is his wont to attend to the job in hand with consummate attention and a single-track mind that led him to win laurels in his academic career throughout. He had uninterrupted university positions all through. He received his M.Sc. (Hons. School) in physics from Panjab University in 1953 and Ph.D. from Aligarh Muslim University, Aligarh in 1956, under Prof. P S Gill. He was awarded an I C I fellowship by the National Institute of Sciences, New Delhi. After his doctorate from Aligarh, he carried out his postdoctoral research at Bartol Research Foundation, Swarthmore, PA (U.S.A.), and later joined the University of Alabama (U.S.A.) as a Visiting Assistant Professor of Physics.

Prof. S. P. Puri retired as Professor and Chairman, Department of Physics, Panjab University, Chandigarh, at the age of sixty. Earlier, he was reader in Physics at the University of Roorkee and Professor and Head, Department of Physics, Punjab Agricultural University, Ludhiana. He visited the School of Quantum Chemistry, University of Uppsala, Sweden, in addition to visiting numerous universities and research institutes in the erstwhile USSR.

He was one of the earliest in INDIA to establish a laboratory for the studies of Nuclear Gamma-Ray Resonance Spectroscopy (Mössbauer Effect) at University of Roorkee (now, IIT Roorkee) in 1963 and established an active school of research there. The traditions of good quality work in Mössbauer spectroscopy set at Roorkee continued there even after his leaving the place. In fact, Professor Puri undertook to write one of the most important chapters of the development of Mössbauer spectroscopy in the Third World. With the help of motivated students, he made valuable contributions to the studies of EFG tensors in single crystals and other diverse studies of minerals and chemical compounds. His other special fields of research interest include the Crystal Field and Molecular orbital theories. It was under his guidance that he supervised many doctoral students on Magnetic and Thermal Properties of Rare Earth Crystals, Magneto thermodynamic Properties of Paramagnetic Ions in Axial Crystal Fields, Impurity Force Constant Estimation in Transition-Metal Ions Ni-Pd System Properties of 3dN4SM Transition-Metal Ions, Crystal field study of thermal and magnetic, Estimation of Impurity-Host to Host-Host Force Constant Ratio for Iron Impurity In Vanadium.

As a mark of his humility, he attributes his professional success to the contributions made by a band of his dedicated students, who, in turn, have distinguished themselves in their professional careers.

His students include Kailash C. Mittal, Deo Raj (deceased), Vijayendra K Garg, N. Malathi, S. P. Taneja, S. S. Nandwani, and Vishwa Mittar. Some of them diversified to other research fields in their career.

Besides his personal qualities, he got complete support and encouragement from his wife, Prof. Ramesh Puri, to devote himself with uninterrupted mind to his academic pursuits. They are blessed with three brilliant sons who are successful in their respective careers and are a source of strength to the family.

Professor Puri has been a dedicated driving force for the improvement of quality education at the university level in India. He has written as many as six physics textbooks for the undergraduate and graduate students on the subjects Mechanics, Vibrations and Waves, Classical Electrodynamics, General Theory of Relativity, and Special Theory of Relativity. These books have been published by Tata McGraw-Hill Publishing Company, Macmillan (India), Narosa Publishing House, and Pearson. Interestingly, a few years back when he was in his late eighties, he wrote two general books. One of these entitled 'Universe by chance or by chance' highlights various viewpoints on the creation of the Universe, and the second book is a guide for school students bringing out the importance of education in life and advises strategy to learn more.

In addition to his deep understanding of physics, he has a good command on English and Persian. He is immensely interested in reading English as well as Persian literature, poetry, philosophy, and biographies of great men. He considers the wisdom lore of the world as his inheritance and his privilege to drink the cup of knowledge. Even at the age of 95, he quotes verbatim the English and Persian literature, particularly Persian couplets, appropriate to the occasion or situation.

Around 1966 the laboratory started successfully generating Mössbauer data and one spectra used to take at least one day and one person dedicate with the spectrometer because to record the data and change the change the velocity and also plot the data.

The first data produced of Mössbauer Studies was on Ferro-and Ferricyanide Super complexes with 3d Transition Elements.
The results of systematic Mössbauer studies of the ferro-ferricyanide super complexes with 3d transition elements (Cr, Mn, Fe, Co, Ni, Cu and Zn) were reported. It was concluded that the coordination number of Fe (II) remains six, and a metal-metal charge transition is involved to explain the data. The nearly double values of quadrupole splitting in the ferricyanide super complexes as compared to $K_3Fe(II)(CN)_6$. And simultaneously studies of Crystal Field Splitting in Fe^{2+} Tutton Salts from Mössbauer studies were the second series of data produced.

The Mössbauer spectra of Fe^{2+} Tutton salts, which form an isomorph double salts series of hydrated double sulphates having the general formula Fe $(MSO_4)_2.6H_2O$. M = NH_4^+, K^+ , Rb^+

and Cs^{+} have been studied in the temperature 77- 300^{0}K. The data was analyzed to assign the characteristic temperature of the t_{2g} levels and find their splitting was concluded that the ground state wave function is singlet |xy> in all these cases. Furthermore, the effect of varying electronegativity of M has negligible effect on isomer shift.

Slowly everyone in the laboratory was worried with the progress of data coming, Every one start thinking improvement of the constant velocity CAM Mössbauer to acceleration, but it did we did not succeed. As a first step replacement of electric/electronic type velocity drive but that was the solution.

On problems related to studies of single crystal were just coming to require most of the dedicated time, and chemical problems like Fe halides or similar got less focus. Professor Puri started focus on crystals. Immediately Studies of Chalcopyrite, pyrite, marcasite, Ilmenite, Ferrous sulphate ($FeSO4.7H_2O$), but these crystal were first to be grown as single crystals, some of these crystals were to be different in structure etc. it was a challenge to grow these crystals. It required patience and the this solved the problem of data slow data generation. Some of the naturally occurring minerals were attempted first in que.

Mössbauer studies of occurring mineral of chalcopyrite have been studied over a temperature range 300 - 448 K . The spectra in weak crystal field config showed a typical of six absorption lines due to the field magnetic field. The Q.S. values which values are independent of temperature whereas the magnitudes of the internal field have are 325 ± 10, 290 ± 10 Koe at 300 at 373 and 448 K respectively. These are feature were explained by assuming that the atom is a spin free, trivalent state configuration. The internal field is accounted to the originate primarily through of the Fermi contact interaction, H_c both the and H_{dip}. H_{orb} both contributions being zero. Another Chalcopyrite study was available in the literature result different than the result produced on the laboratory, It was published as a critique in Nuovo Cimento and gave us confidence.

Studies of EFG and MSD studies of $FeSO_4.7\ H_2O$, $FeSO_4.4H_2O$, $FeSO_4.H_2O$, $FeSO_4$, $Fe(KSO_4)_2.6H2O$, $Fe(NH_4SO_2)_2.6H_2O$, Ilmenite $FeTiO_3$, Sodium Nitroprusside $Na_2[Fe(CN_5NO].\ 2H_2O$, alpha Fe_2O_3 started with full dedication.

Mössbauer spectra in a single crystals of $Fe(KSO_4)_2.6H_2O$has been studied as a function of the orientation of the crystal axes with respect to the direction of the unpolarized gamma rays beam. The analysis of the area ratios quadrupole split double spectra yields the principle axes the asymmetry parameter of the direction cosines of the EFG with respect the crystal axes The absorption of the Fe^{57} in synthetic of the Monohydrate $FeSO_4.4H_2O$ been studied as function of the of crystal axis with respect to the EFG tensor gamma ray beam the temperature of 100-77 k. Analysis of the peak area ratios of the give quadrupole spectra and the N and the mean square displacement $<r^2>$ as a function of temperature η on good agreement curve the lattice with the sum calculation. for the MSD the polarization of the absorption cross section

has been taken into the account into Cal cutting the absorption spectra and $<r^2>$ is 0.8×10^{-18} m^2 at 300 K

Prof Puri was and is kind and helpful teacher with a friendly atmosphere. The students were at invited at home. He is very hard working and his students attained this quality

The students will like to mention with thanks friendly teachers I P Saraswat (Chemistry) and V K Deve (Geology)

Photo of Professor Satya Pal Puri September 2025

Contributed by
Kailash C. Mittal, Deo Raj (deceased), Vijayendra K Garg, S. P. Taneja, S. S. Nandwani, and Vishwa Mittar