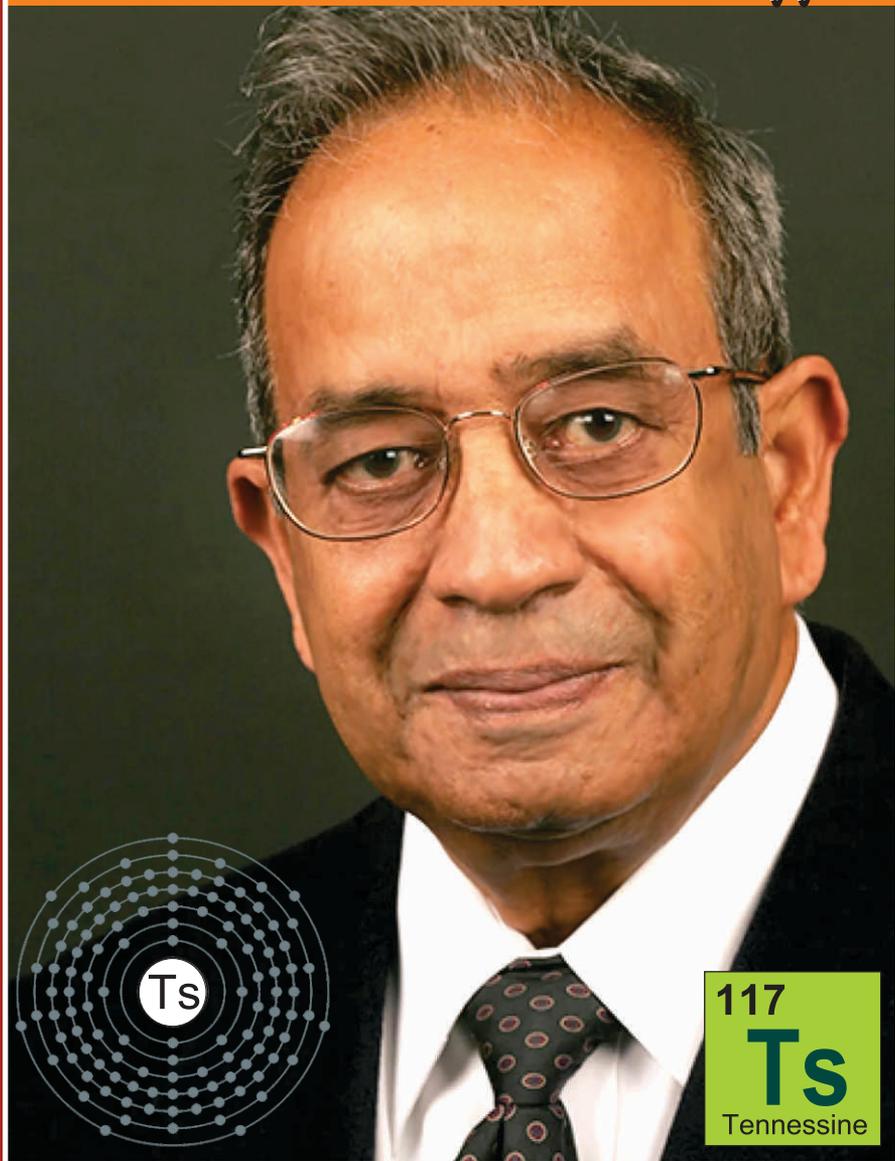


Nuclear Physicist

Dr. Akunuri Venkata Ramayya



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Tennessee

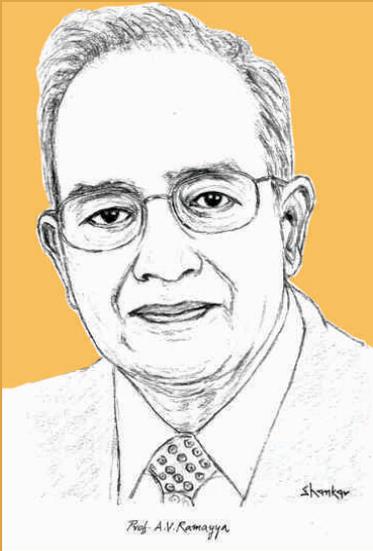
Dedicated by:

Myneni Gopala Krishna

Congressman Cooper honors Hamilton and Ramayya for super heavy element discovery



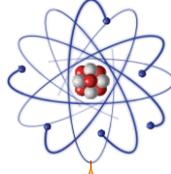
L-R: Prof. AV Ramayya, Rep Jim Cooper and Joseph Hamilton (Joe Howell/Vanderbilt)



Prof. Dr. Ramayya's sketch drawing by Artist Sri Sankara Narayana Sattiraju



Smt. Krishnamayi's colour painting by Artist Sri Bapu



Nuclear Physicist
Dr. Akunuri Venkata Ramayya

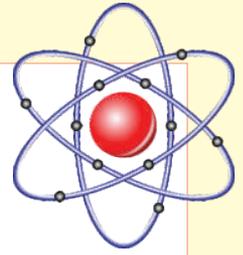
Script:
Gabbita Durga Prasad

Dedicated by:
Myneni Gopala Krishna

Supervision:
Dronavalli Ramamohana Rao

Layout :
Karri Siva Prasad





Nuclear Physicist

Dr. Akunuri Venkata Ramayya

By **GABBITA DURGA PRASAD**

First Edition 20 ,October 2020

Copies 500

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Cover Design & Layout Karri Sivaprasad

For Copies

Gabbita Durga Prasad

President . "Sarasabharathi "

H.No: 2-405, Sivalayam Street

Near Raja gari Kota ,Vuyyuru - 65,

Krishna District . AP.

Ph: **08676-232 797**, Cell -**9989066375**

e-mail: gabbita.prasad @gmail. Com

Myneni Gopala Krishna

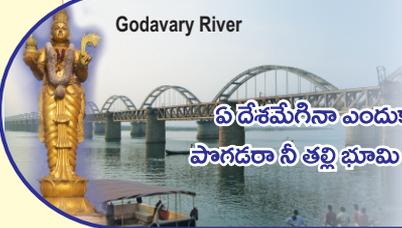
2227 Cecille Dr.

Huntsville, Alabama - 35803 USA

Ph: **+256 882 5586**

gmyneni008@gmail.com

Godavary River



ఏ దేశమేగినా ఎందుకాలిడినా - ఏ పీఠమెక్కినా ఎవ్వరేమనినా -

పాగడరా నీ తల్లి భూమి భారతని - నిలవరా నీ జాతి నిండు గౌరవము

- రాయప్రోలు సుబ్బారావు

Tennessee River



Dedicated to
My Mother



Late Smt. **Akunuri Venkata Subbamma** Garu

(April 16, 1921 - February 1, 2002)

*"For my sake, she has melted like camphor,
She has always wanted & dreamt about me
achieving big. To the person who has given birth to
me, is my tribute to all the priceless sacrifices that
she has made - dedicating this new found discovery
of mine
in remembrance of her."
with Love,
Ramayya.*



My Mentor



Prof. **Swami Jnanananda**

Andhra University, Waltair

A rare classical saint and a great modern scientist. One of the greatest personages the world can truly be proud of has been Swami Jnanananda. Born on 5th December 1896, in Goraganamudi in West Godavari District of Andhra Pradesh, India, the son of Bhupathiraju Rama Raju and Sita Devi. Swami Jnanananda left for the Himalayas when he was 21. There he practiced yoga, studied Vedic literature and "transcended" into being a legendary saint. He wrote poems, commentaries on classical Vedic philosophy, even original masterpieces like Purna Sutras.

In 1927 he left India for Germany where he lectured on Vedic philosophy. However, he used his stay there to study mathematics and theoretical and experimental physics at the College of Science and Technology, Dresden. He then took up research in High Tension and X-Ray Physics at the Charles University, Prague, where he was awarded the degree of Doctor of Science.

At the beginning of World War II, he left Germany and reached England where he joined the University of Liverpool and did remarkable researches in Nuclear Physics, Spectroscopy of Beta-radiations. He was awarded a Ph.D. there. During this period he became Fellow of London's famous Institute of Physics and wrote a book on high vacuum.

At the peak of World War II, he was invited to the University of Michigan, Ann Arbor in the United States where he carried out important research work in Nuclear physics for three years.

He came back to India in 1947 and joined the National Physical Laboratory in Delhi. In 1954 he came to the Andhra University and did outstanding research work in nuclear physics. He passed away in 1969.

"*The Saint & The Scientist*" is an outstanding book presenting for the first time to the Western world the Swami's autobiography as well as a selection of his important spiritual, philosophical and scientific writings.

University Resources Press, Washington, D.C



Foreword

It is indeed proud achievement for me to have written 18 books out of the 30 books that have been published Sarasabharathi, literary and cultural organisation. Among them is a book on our Telugu scientists and the Father of Chemmotology Kolachala Seeta Ramayya. This book on Dr Akunuri Venkata Ramayya is my 19th and Sarasabharathi's 31st book.

We would like to acknowledge the fact and also thank Uyyuru native NRI living in America Mr Myneni Gopala Krishna and his wife Mrs Satyavathi for their support and financial help in bringing out 8 books till date and even this 9th book. Sarasabharathi would like to thank the couple for their generous gesture.

We would also like to thank Dr AV Ramayya for accepting us to write a book on him. His wife Mrs Krishnamayi also was happy to share all the information regarding their family, early life and education of Dr Ramayya. She shared lots of information, and photos that has shaped this book.

I must emphasise a special thanks to Mr Gopala Krishna for connecting me to Dr Ramayya and building an amicable atmosphere between us so that I could pursue my goal of collecting all the information and write this book. This is book is the result of two good persons cooperation and help.

We wish that this book on Dr Ramayya's life will stand as an inspiration to future generations and researchers.

Gabbita Durga Prasad
President, Sarasabharati



Context that made this Booklet

US-based India West magazine published an interesting article called “Latest Periodic Table Element Found by Dr Akunuri Ramayya led Research Team Gets Name”, and Mr Myneni



Latest periodic Table Element discovered by
Dr. Akunuri Ramayya led Research Team Gets Name

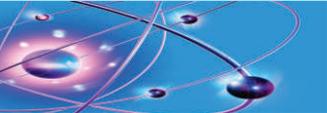
Gopala Krishna sent this article to me. I was surprised to realise the fact that Indian and that too, Andhra scientists has instrumental in the discovery of 117th Element in the Periodic Table. He mentioned in the mail that there was need to tell about this great scientists to all literary friends and Telugu people of Sarasabharathi. Mr Gopala Krishna expressed the desire to publish a booklet through Sarasabharathi.

The process started with Mr Gopala Krishna making telephonic-introduction of Dr AV Ramayya. He created an environment for us to speak over the phone and parallel collected lot of information on the Nuclear Physicist which developed into booklet called 'Nuclear Physicist Dr Akunuri Venkata Ramayya'.

I am ever thankful to Mr Gopala Krishna for sending the article published in the English magazine and his perseverance that has led to publishing a booklet on this great and inspiring scientist. It has also led to enlightening ourselves on the discovery of a new element and that too in simple and easy-to-understand manner.

I am thankful for giving me an opportunity to write about this highly talented and proud to have got chance to learn about this inspiring personality.

- Gabbita Durgaprasad



Nuclear Physicist

Dr Akunuri Venkata Ramayya

India, is known as the land of 'Vedas', and we have always believed that the Vedas have abundant scientific knowledge. Great Sages like, Dhanvantari, Charak, Sushrutha, Bharadwaja were great scientists and Brahmadduttas, Arya Bhatta Bhaskaracharya, Acharya Nagarjuna from middle ages and in modern times Dr CV Raman, Jagadish Chandrabose, Subrahmnaya Chandra Sekhar, Homi Babha are some of the renowned scientists from India.

Sri Kolachala Seetaramaih, Suri Bhagavatham, Yarlagadda Subbarao, Yalavarthi Nayudamma, K L Rao and A S Rao are the most renowned scientists from Telugu speaking states. The renowned Indian Scientist Swami Gnananda has established the Nuclear Physics department in Andhra University. But there is none from our Telugu states who has discovered an element in periodic table until Anukuri Venkata Ramayya, the award winning Nuclear Physics scientist. He was instrumental in the discovery of 'Tennessine', the Element number 117 in Seventh period of Periodic Table. He achieved this after a prolonged research in the USA. This book is a small effort to introduce the scientist who made Telugu people proud with his huge contribution to the scientific world.

Early Life of Sri Akunuri Venkata Ramayya

Dr Akunuri Venkata Ramayya, the discoverer of the 117th Element in the Periodic Table, was born in Akunooru village near Uyyuru in Krishna district on August 15, 1938 to Sri Venkat Rao and Smt Venkata Subbamma. He was named after his grandfather.

Ramayya was the eldest among his siblings. He has three younger brothers and three sisters. Among them his first younger brother Raja Rao passed away, his wife and children are living in



Washington DC. Second is Sri Hari Krishna lives in America. He retired from Tennessee State water Control department. Third brother Sri Venkataramana works for US Federal Government's Revenue Services and lives in Washington DC. Ramayya took up the responsibility of his brothers' education and later settle in the USA. His first sister Mrs Sita, whose daughter married his youngest brother Sri Venkataramana; second is Mrs Anuradha, retired from Machlipatnam Hindu College and now lives in Vijayawada; and third sister is Mrs Talluri Rajyalakshmi.

Ramayya's father was working at Motor and General Trading company in Vijayawada. Hence he got opportunity to study in Vijayawada. He completed his S.S.L.C. in 1952 from Chundurri Venkata Reddy Government Municipal High School. Later in 1954 he passed Intermediate course from SRR & CVR College in Vijayawada. Over a period of time he became known to people as AV Ramayya.

Higher Education

AV Ramayya was brilliant student and pursued higher education in Andhra University, where he completed B Sc (Honors) in 1957 and M Sc in Nuclear Physics in 1958, he was university second rank holder.

He immediately went to the USA to complete his Ph D programme in Indiana University and achieved it in 1965.

Personal Life of Rammaya

Mrs Krishnamayi, daughter of Dr Palakodeti Rama Mohan Rao (Rambabu), got married to AV Ramayya on August 22, 1965 in Rajahmundry. At the time of marriage Ramayya was 28 years while Mrs Krishnamayi was 20 years old. Coming from the family of freedom fighters and having been educated in a healthy atmosphere, Mrs Krishnamayi has been inclined towards social service right from young age. She stood in front to help the poor and needy people.



Top : Left to Right) 1. Late Raja Rao 2. Anuradha(Vijayawada)Rt. from Hindu College, Machilipatnam 3. Sita (Vegaraju) 4. Talluri raja Lakshmi 5. Hari krishna
Top Row: 1. Ramayya garu 2. Father 3. Mother (pregnant)
Row below: Ramayya's marriage photo with parents

Mrs Krishnamayi has two sisters: Mrs Kasturi Revathi, her husband Mr Kasturi Subba Rao, Physicist at Thumba Rocket project; another is Mrs Kaligotla Krishnaveni, her husband is Dr Kaligotla Gangadhar, MD, renowned medical doctor in



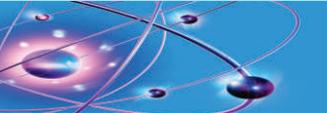
(Left to Right) 1. Radhika (Daughter) 2. Sarath (son) 3. Briyana (Grand daughter)
4. Smt. Krishnamayi 5. Prof. Ramayya

Bhimavaram, West Godavari district.

Mrs Krishnamayi has three brothers: Mr Gurumurthy, lives in Rajahmundry; other two brothers Mr Raja Rao and Mr Swayam Prakash have passed away.

Ramayya's father passed away in 1966 when he was 54 years. From then Ramayya's mother took the responsibility of taking a growing up the children. She took care of all the daughters and got them married. After the death of Ramayya's brother Mr Raja Rao, she was guardian for that family as well. She would frequently visit Ramayya and family at Nashville. She was popular for her advices to families and young brides. Her "counselling" has helped many people lead happy lives. She was popular for even mending ways of many. This was the reason people respected her very much and obeyed her words. She passed away in 2002 at the age of 82.

Mr and Mrs Ramayya have two children, daughter Radhika a ball room dancer and runs a studio of her own in Nashville.



Radhika's daughter (granddaughter of Ramayya) Briyana is studying Eighth Grade and is inspired by her grandfather very much. "I am influenced and inspired by my grandfather to study and success," Briyana proudly says. Their son Sharath is an engineer and works as Internet Business Consultant with Carter Children's Clothing in Atlanta, Georgia state.

Path to Discovery

Dr AV Ramayya has always been fascinated by existence of superheavy elements and this made him take up continuous research which led to the discovery of the 117th element of the periodic table, recently named Tennessine.

Recollecting his journey from Andhra Pradesh to the USA and becoming the discoverer of 117th Element in the periodic table, Dr AV Ramayya said about how he started off. He left to Visakhapatnam in 1954 to do B Sc (Honors) with Physics as the main subject in Andhra University. He completed his Masters in Nuclear Physics from the same University. He always acknowledges the guidance of Head of Physics department in Andhra University Prof Gnananada. It was the professor who had recommended AV Ramayya to Indiana University in the USA, from where he had completed his Ph D.

At Indiana University his Ph D guide and adviser was Prof ML Langar and he presented a thesis on Nuclear Structure. After completion of Ph D, Ramayya moved to Vanderbilt University and started working on research along with Dr Joseph Hamilton. Recalling his association with Dr Hamilton, Ramayya said he was a very good friend.

Tennessine was discovered by researchers belonging to the Joint Institute for Nuclear Research in Dubna, Russia, the Lawrence Livermore National Laboratory in California, USA, and Oak Ridge National Laboratory in Tennessee, USA. Among the 20 researchers Ramayya and Hamilton from University of Tennessee

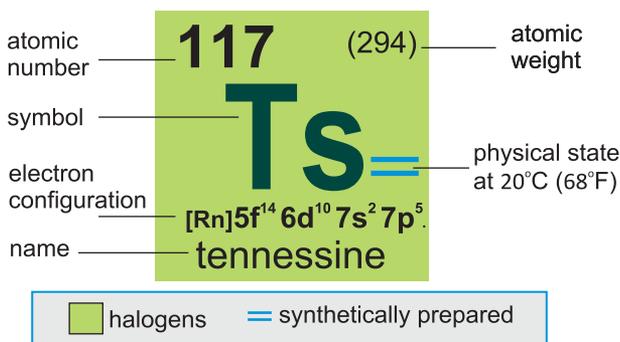


played a key role. Most of the research took place in Russian because of the availability of Cyclotron and Recoil Mass Separator there, Ramayya mentioned. The research for the discovery of 177th Element took around one and half year time.

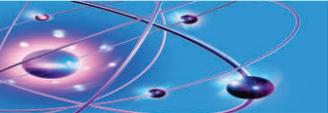
In April 2010, the element was discovered and it was named Tennessine in 2016 and its symbol is Ts. The element's life time is just 100 milliseconds. “The element was discovered in Radio Active Isotope when it was in “High Activated State”,” said Ramayya.

Elements – Periodic Table

What are these Elements? Why should they be arranged in a periodic table? An element is a substance whose atoms all have the same number of protons: another way of saying this is that all of a particular element's atoms have the same atomic number. Elements are chemically the simplest substances and hence cannot be broken down using chemical reactions.



The periodic table (also known as the periodic table of elements) is organized so scientists can quickly discern the properties of individual elements such as their mass, electron number, electron configuration and their unique chemical properties. Metals reside on the left side of the table, while non-metals reside on the right. Organizing the elements to help further



our understanding was first provided by Dmitri Mendeleev.

This periodic table of the elements with names, atomic number, symbol and mass is colour-coded for easier reference by students and researchers. For quick reference, go to the periodic table chart with names listed alphabetical order.

In the modern periodic table, the elements are listed in order of increasing atomic number. The atomic number is the number of protons in the nucleus of an atom. The number of protons define the identity of an element (i.e., an element with 6 protons is a carbon atom, no matter how many neutrons may be present).

In a periodic table arranged in order of increasing atomic number, elements having similar chemical properties naturally line up in the same column (group). For instance, all of the elements in Group 1A are relatively soft metals, react violently with water, and form 1+ charges; all of the elements in Group 8A are unreactive, monatomic gases at room temperature, etc. In other words, there is a periodic repetition of the properties of the chemical elements with increasing mass.

There are 18 groups and 7 periods in a periodic table. The number of protons determines how many electrons surround the nucleus, and it is the arrangement of these electrons that determines most of the chemical behaviour of an element. For example: in the 17th group and 7A of periodic table we can see Halogen element. Halogen means salt from the sea, this means that the element has been extracted from the salt. Tennessine which is part of this group has been discovered by Dr AV Ramayya. If we notice as we go down the elements in this group the electrical value of the elements are decreasing. Similarly we can notice that element electrical value increases as we move from left to right in the periodic table.

The total number of protons present in the nucleus of every atom of a chemical element represents the atomic number of that



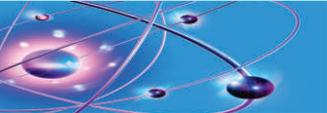
element. Each element is characterized by a unique atomic number. It is represented by the letter “Z.”

Along with this there has been a great development in science due to quantum mechanics, this has enabled us to divide an atom into four quantum values. There is a set of quantum numbers associated with the energy states of the atom. The four quantum numbers n , l , m , and s specify the complete and unique quantum state of a single electron in an atom, called its wave function or orbital. The Aufbau principle states that an electron occupies orbitals in order from lowest energy to highest.

Based on the electronic configuration of the elements, s, p, d and f elements have been classified as four blocks. Elements belonging to Halogen family are in v 11/17 group and have electronic configuration of $ns2np5$. Elements in s, p blocks are considered as representative elements. Just like the atomic number, mass index of element is also stable. There are occasions when a single element will bore more than one atom and will have similar number of protons as well neutrons. This element is called isotope. Many elements in nature are combination of one or more isotopes. Chlorine, of Halogen group, is found in isotopes with mass index of 35 and 37. Isotopes are useful in understanding chemical and medical mysteries!

The basic understanding of elements will help us appreciate the work of Dr Ramayya better. There is also need to have some understanding of atomic energy. The heat generated through atomic energy is used in steam turbines and electricity is produced through atomic reactors. Nuclear power is achieved through nuclear fission, nuclear fusion and nuclear decay.

At the bottom of the periodic table is a special group of metallic radioactive elements called actinides. There are 15 actinide elements, they are Actinium (Ac), Thorium (Th), Protactinium (Pa), Uranium (U), Neptunium (Np), Plutonium (Pu), Americium (Am), Curium (Cm), Berkelium (Bk), Californium (Cf),



Einsteinium (Es), Fermium (Fm), Mendelevium (Md), Nobelium (No) and Lawrencium (Lr).

Radio isotope of nuclear decay is used for generation of thermoelectricity. Fusion is still in early stages. Nuclear power is safe for environment because it emits very less carbon.

Tennessine, the 117th element discovered by Dr Ramayya is synthetic chemical element. This is the second superheavy element and this is the reason it is in the seventh period of the periodic table just above the last element. The 117th element was discovered in April 2010 at Dubna, under Russian – American collaboration. In 2011 the researcher created isotopes from this elements and confirmed their research. Once again in 2014, the same team under German-American collaboration conducted research on this element. Joint Working Party of the International Union of Pure and Applied Chemistry (IUPAC) and International Union of Pure and Applied Physics together recognised the joint efforts of Russian and American teams in 2015. In June 2016, the name Tennessine was proposed since most of the research took place in the state of Tennessee. And in November 2016, it was officially announced the new element discovered is named as Tennessine. It was long and tiresome journey of six years for all from discovery to naming the element. At the end it was a fruitful one for Dr Ramayya.

Tennessine element is a volatile element, doesn't emit ions and never achieves high oxidation state. The state of melting and evaporation of this element is very similar to Halogen. Since it is radioactive substance hence it produces only atmos. This is the reason the element's usage is restricted to only research. Its electronic configuration is 5f146d107s27p5.

Tennessine element atomic number is 117 and atomic weight is 294. Before the discovery of 117th element, Oganesson was discovered at Joint Institute for Nuclear Research in Russia's Dubna. Its atomic number is 118 and is known as Og. This is



highest atomic number in the periodic table and is a radioactive element. This is also a volatile element and is considered as non-metal.

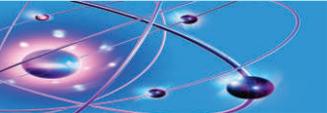
Dr AV Ramayya explanation about Periodic Table :

Dr AV Ramayya's explanation about the periodic table: "An atom is the smallest particle of an element which will retain the properties of that element. Atoms are made of protons, neutrons and electrons. The nucleus of an atom is the location where protons and neutrons are found. The electrons are found in a region of space called the electron cloud.

PERIODIC TABLE OF THE ELEMENTS

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|-----------------------|-----------------------|-----------------------|--------------------------|------------------------|------------------------|-----------------------|-----------------------|------------------------|-----------------------|-------------------------|-------------------------|-----------------------|--------------------------|-----------------------|-------------------------|----------------------------|----------------------|-------------------------|----------------------|----------------------|-------------------------|---------------------------|--------------------------|--------------------------|-----------------------|------------------------|------------------------|--------------------------|-------------------------|------------------------|
| 1 H Hydrogen | | | | | | | | | | | | | | | | | 2 He Helium | | | | | | | | | | | | | | |
| 3 Li Lithium | 4 Be Beryllium | | | | | | | | | | | 5 B Boron | 6 C Carbon | 7 N Nitrogen | 8 O Oxygen | 9 F Fluorine | 10 Ne Neon | | | | | | | | | | | | | | |
| 11 Na Sodium | 12 Mg Magnesium | | | | | | | | | | | 13 Al Aluminum | 14 Si Silicon | 15 P Phosphorus | 16 S Sulfur | 17 Cl Chlorine | 18 Ar Argon | | | | | | | | | | | | | | |
| 19 K Potassium | 20 Ca Calcium | 21 Sc Scandium | 22 Ti Titanium | 23 V Vanadium | 24 Cr Chromium | 25 Mn Manganese | 26 Fe Iron | 27 Co Cobalt | 28 Ni Nickel | 29 Cu Copper | 30 Zn Zinc | 31 Ga Gallium | 32 Ge Germanium | 33 As Arsenic | 34 Se Selenium | 35 Br Bromine | 36 Kr Krypton | | | | | | | | | | | | | | |
| 37 Rb Rubidium | 38 Sr Strontium | 39 Y Yttrium | 40 Zr Zirconium | 41 Nb Niobium | 42 Mo Molybdenum | 43 Tc Technetium | 44 Ru Ruthenium | 45 Rh Rhodium | 46 Pd Palladium | 47 Ag Silver | 48 Cd Cadmium | 49 In Indium | 50 Sn Tin | 51 Sb Antimony | 52 Te Tellurium | 53 I Iodine | 54 Xe Xenon | | | | | | | | | | | | | | |
| 55 Cs Cesium | 56 Ba Barium | 57 La Lanthanum | 58 Ce Cerium | 59 Pr Praseodymium | 60 Nd Neodymium | 61 Pm Promethium | 62 Sm Samarium | 63 Eu Europium | 64 Gd Gadolinium | 65 Tb Terbium | 66 Dy Dysprosium | 67 Ho Holmium | 68 Er Erbium | 69 Tm Thulium | 70 Yb Ytterbium | 71 Lu Lutetium | 72 Hf Hafnium | 73 Ta Tantalum | 74 W Tungsten | 75 Re Rhenium | 76 Os Osmium | 77 Ir Iridium | 78 Pt Platinum | 79 Au Gold | 80 Hg Mercury | 81 Tl Thallium | 82 Pb Lead | 83 Bi Bismuth | 84 Po Polonium | 85 At Astatine | 86 Rn Radon |
| 87 Fr Francium | 88 Ra Radium | 89 Ac Actinium | 90 Th Thorium | 91 Pa Protactinium | 92 U Uranium | 93 Np Neptunium | 94 Pu Plutonium | 95 Am Americium | 96 Cm Curium | 97 Bk Berkelium | 98 Cf Californium | 99 Es Einsteinium | 100 Fm Fermium | 101 Md Mendelevium | 102 No Nobelium | 103 Lr Lawrencium | 104 Rf Rutherfordium | 105 Db Dubnium | 106 Sg Seaborgium | 107 Bh Bohrium | 108 Hs Hassium | 109 Mt Meitnerium | 110 Ds Darmstadtium | 111 Rg Roentgenium | 112 Cn Copernicium | 113 Nh Nihonium | 114 Fl Flerovium | 115 Mc Moscovium | 116 Lv Livermorium | 117 Ts Tennessine | 118 Og Oganesson |

"God has created an antenna which is devoid of electric charge in every person. Just imagine that you have one per cent extra electrons and another person has one per cent extra positive cells in the nucleus, then the attraction from both will be equal which is also equal to the weight of the earth! Importantly the protons in nucleus will have positive electric charge.



“In 1869 Russian professor of chemistry, Dimitri Ivanovich Mendeleev gave the formal birth of the modern periodic table. It included 62 known elements arranged according to increasing atomic weight; Mendeleev also left spaces for as yet undiscovered elements for which he predicted atomic weights. In 1874-75 the Scandinavian element was discovered, which is in-between Calcium and Titanium in the periodic table. Later elements in-between Zinc and Arsenic, Germanium and Gallium were discovered.

“Neils Bohr created his own version of the table in 1922, based on experimental measurements of electron energies (along with some guidance from the periodic law). Bohr's table added elements discovered since 1869, but it was still, in essence, the periodic arrangement that Mendeleev had discovered. In 1922 Hafnium with atomic number of 72 was discovered at Bohr Institute in Copenhagen. The element was named Hafnium, after Hafnia, the Latin name for Copenhagen, where it was discovered. With the introduction of Electronic Spin, the electronic configuration of periodicity was completed. This is the history of periodic table till date,” Dr Ramayya said.

An Interview With A V Ramayya, Discoverer Of The 117th Element In The Periodic Table by

Swarajya Magazine

Akunuri V Ramayya is a physicist and Professor of Physics at Vanderbilt University. He was part of an international collaboration that discovered the 117th element of the periodic table, recently named Tennessine.

Ramayya earned his Bachelor's and Master's degrees at Andhra University in India before moving to the United States to receive his doctorate degree from Indiana University. From then on, he held positions at various universities, predominantly at



Vanderbilt University, where he has been a professor since 1980.

Karan Jani spoke to Prof Ramayya on behalf of Swarajya about his discovery, nuclear energy technology and the state of science education in India, among other things.

Jani is a doctoral researcher in astrophysics and a scientist in the gravitational-wave experiment LIGO. A large part of his job is to understand black holes and test out Einstein's General Theory of Relativity. A co-recipient of the Special Breakthrough Prize in Fundamental Physics, he was part of the LIGO team which detected the first gravitational waves.

This is Jani's interview with Ramayya (edited for clarity):

So, professor, do the students of chemistry now have to learn about one more element in the periodic table?

Dr Ramayya: (Chuckling) They have to learn one more element in the period table, yes. It's a Group 7. So it has the same electronic structure as that of Chlorine, Bromine, Iodine, Astatine. Tennessine will fall into this group. That's how the name Tennessine came about.

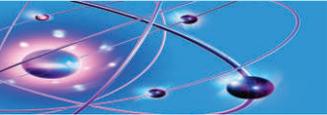
I see. So, the fact that it is one of the halogens? That's how?

Dr Ramayya: Yes, that's right. (Halogens are given names that end in the suffix "-ine.")

What does it mean to have a new element added to the periodic table?

Dr Ramayya: The purpose of trying to produce the heavier elements is to locate the next magic number. For example, in the nuclear shell model, the elements with a proton number or a neutron number, like 2, 8, 20, 28, 50, 82 and 126 -- these are called the magic numbers. And the elements with these magic numbers are more stable and have large isotropic change.

Now, the question is, what is the next magic number for the



protons? So far, you know, the last magic number for protons is 82. What is the next magic number? For neutrons, we know it's 126. So, the aim is to reach that magic number, and if we do, the elements will be more stable, and live for a longer time, and will probably have more uses for the general public.

In terms of wider applications in the field of technology, what suggestions can you put forward?

Dr Ramayya: Right now, we produce a small number of atoms. But in Russia, they are building a bigger factory to produce the elements in large quantities. Once we do that, and we study the chemical properties of it, it will be a lot more useful in nuclear medicine and nuclear energy and so on.

Could you briefly describe the timeline, and how you went about making Tennessine, as well as your involvement in the process?

Dr Ramayya: This (Tennessine) is produced by bombarding Berkelium 249 target with Calcium-48 B. The fused combined atom for nucleus then achieves a higher excitation energy, and it evaporates a certain number of neutrons. In this case, it was four neutrons. That is how Tennessine is produced to 117 atomic number. Because the atomic number of Calcium is 20 and that of Berkelium is 97, and if you add the two, you get 117. The neutron number will be something different -- it sometimes evaporates four neutrons, and at other times, three. And that's how this element is produced.

You should remember, the cross-section is very, very, very small. So it took us about two years of beam time to produce only about 14 or 17 atoms -- I don't remember exactly. That's how it's done. So, in the future, when the super-heavy factory is built, it will probably produce in thousands of quantities, or maybe in microgram quantities.

Is this a type of element that we can find naturally



'Magical pair' Dr. Hamilton and Dr. Ramayya

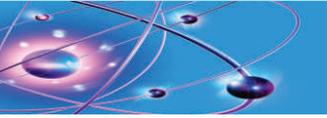
produced in the universe in some kind of an extreme process like the supernova?

Dr Ramayya: It is possible. In supernova explosions, and there are some attempts now being made to look for these kinds of things, it is possible that you might find these super-heavy elements. It takes some time.

Can you list some grand, open problems in nuclear physics that you believe we would now be a little closer to cracking because of this new ability to produce heavy elements stably?

Dr Ramayya: I think one will be able to understand more about the stability of the nucleus, and on how to predict the future stable nuclei, and what their properties are. But physics is an experimental science, and finally the outcome is decided only by the experiment and not theory. Theory gives us some direction, but we have to prove it by experiment.

One of the grand problems is to produce super-heavy elements.



Another is to produce nuclei far from the line of beta stability. These experiments are nowadays being done in Michigan State University. We participated in some of these experiments. We also participated in Russia in looking for these super-heavy elements. This takes time and a lot of money.

To produce Tennessine, if I have to put a price tag on it, it will run into millions of dollars. It is not that easy to get that kind of funding. This happened by accident in a way.

In these six decades of a monumental academic career, what are the things that you feel have stayed with you as a scientist, since you started your career in Andhra Pradesh and up until now?

Dr Ramayya: From Andhra, I came to Indiana University in Bloomington. I got my PhD there, in a record time of three-and-a-half years. Then, I came to Vanderbilt University (Nashville, Tennessee). In the meantime, I spent a year in Germany, and a year in Holland – several summers in Holland, and several summers at Oak Ridge National Laboratory and Argonne National Laboratory, and Rochester. In fact, the experiments we did it at Rochester, the same type of experiments are done in Dobra, to produce Tennessine 117. I think I should say I'm lucky in some sense.

After this long academic career, is there some sort of a grander quest that keeps you driving to pursue fundamental problems in physics?

Dr Ramayya: I always liked fundamental physics. That was always my main goal. Even from India, I wanted to do this kind of research. I knew exactly what kind of problems I should tackle, and those are the ones I did.

When I was entering the field of nuclear physics, it was probably at the real cusp, because that was the time when nuclear energy was found, as well as non-conservation of parity, and there were lots of fundamental things which were exciting, and so we came here and did all those things.



You spoke about science funding. A constant debate that goes on in academia is on the stringent science funding. When you reflect on the relationship between science and government over the decades, do you think now there is more disconnect than before?

Dr Ramayya: I think the US government doesn't have a long-range science policy. That is the biggest problem that we face in America.

There are better policies in Germany and other places. In America, we simply go from one year to the next. That is the biggest challenge.

I don't know what kind of a science adviser President-elect Trump will choose. We had a good science policy when Allan Bromley was science adviser, but after that it hasn't worked very well for us.

Do you also think that, in part, the way academia and the scientific community work, we have failed to produce communicators and policy-makers, and have rather gotten into the loop of maintaining publication records?

The scientific community has failed to communicate with the public. What we are doing must be communicated to the public in simple terms.

We should make every attempt to go to universities and other public places to explain to the general audience what we are doing. Because ultimately, the Congressmen and the Senators approve the budget. So it is very important to talk to them as much as possible, as well as to the general public.

In fact, a couple of years ago, when I went to India, I gave a speech at the Birla Centre. There were about 200 people, the room was full. They didn't know that the nuclear reactor will not explode like an atomic bomb. Everyone thought the nuclear reactor, when it goes critical, will explode like an atomic bomb. This never happens with a nuclear reactor, it just dies.

See, what happened in Japan a couple of years ago,



A memorable picture on the occasion of Dr. Ramayya's Birth day

because of the enrichment of the uranium material. For an atomic bomb, the enrichment has to be above 90 per cent. For nuclear reactors, the enrichment is only about 10 to 15 per cent. So, the fuel will never reach the critical stage to explode.

In India, we have recently seen investment in mega science projects like the LIGO detector, Indian Neutrino Observatory, the ITER, etc. But do you think that India has, in the past, missed opportunities to be part of breakthrough research?

Dr Ramayya: India has great potential. They are building the LIGO station in Maharashtra. That's a great opportunity, and we must make use of it. India is also building a lot of nuclear reactors. But the only problem in India is, people have to be educated. They do not understand how to control the reactors and the consequences of not controlling it. As long as they are educated, and have the right people at the control centres, I think that's (nuclear energy) the future of India – the future energy source, not only for India, but all over the world.

So, you believe it is critical for India to invest in nuclear reactors and nuclear energy?



Dr Ramayya: Oh, yes, definitely, as fast as they can. People should not be afraid of it. If you look at the statistics, in the nuclear disasters of Chernobyl and Fukushima, the number of people who died were very, very small; you can count them on your fingers. People are unnecessarily scared of nuclear energy.

In India, we have the research institutes to handle research, and colleges do the teaching. Is that a good model? Or do you think we should follow the US model instead?

Dr Ramayya: The best source of intellectuals is at the universities, and they (universities) have to be the grounds for building great students.

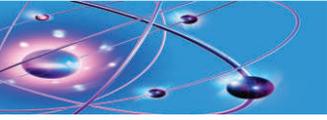
India, in terms of intellectual ability, is number one in the world, I think. I get a lot of students from India, and also from China, and they are outstanding. They are the real source of knowledge. Universities should promote a lot of research.

We used to have good people in the past in the universities. Now, it has gone down in some sense. Now they have national labs. I used to be on the advisory committee for the nuclear science centre in Delhi. It takes some time to build that model, which we have to promote as much as we can.

The way science is taught in high schools in India -- do you think we need to fundamentally redefine that approach? There is now this rush to prepare for the ultra-competitive entrance exam to join an IIT or other such institutes. But in the process, we are not teaching the science right.

Dr Ramayya: In fact, we are not teaching the science right in the universities. Up to the high school level, they are doing fine; but when it comes to colleges and universities, I don't think they are doing it right. This the biggest problem in some of the universities, especially Andhra University.

Is it also the trend in India in particular that fundamental or basic science is not given the same attention as engineering or other fields?



వాండర్ బిల్ట్ యూనివర్సిటీ



Dr Ramayya: Fundamental science is important, and engineering and fundamental science have to go side by side. But basic science, even here (US), will probably not fetch you much money. Nowadays, nanotechnology is the buzzword. Everyone wants to do nanotechnology. Some practical applications should be supported, but it has to go hand in hand. Unless you develop the fundamental science, you can't develop applications.

When we discovered the electron, who expected it would have such an impact on the world. So, it takes a while.

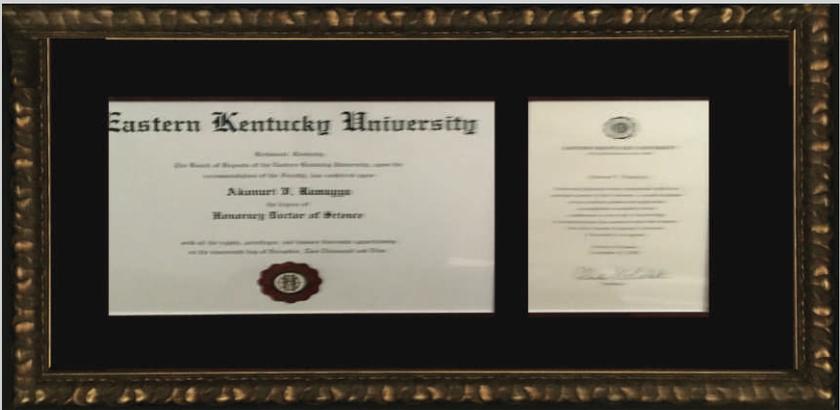
What wisdom could you share with a student who is starting a doctorate in physics?

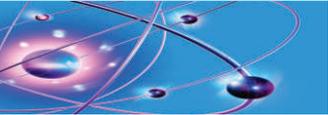
Dr Ramayya: He has to be persistent, and ask many questions that people never thought of asking.

There are no stupid questions in this world, just maybe stupid answers.

The wisdom I would give is, look into various fields and see what the future is, and what kind of questions you are trying to answer. That takes some effort. There are a lot of opportunities for people in this country and everywhere in the world.

Thank you, professor, for sparing some time and speaking to us.





Dr AV Ramayya's Professional Life

- ✦ In 1964 summer Dr Ramayya was Research Associate at Indiana University.
- ✦ From 1964-69 he was a Research Associate at Vanderbilt University.
- ✦ In 1969 summer he was Director of College Teachers Institute.
- ✦ From 1969-70 he was a Senior Research Associate and Lecturer at Vanderbilt University.
- ✦ In 1970-71 he was the Visiting Professor at Delph Technical University in The Netherlands.
- ✦ From 1970-75 he was Associate Professor at Vanderbilt University.
- ✦ In 1972 and 1975 summer he was associated with Oakridge National Laboratory.
- ✦ In 1979-80 he became the Associate Professor of Physic at Vanderbilt University.
- ✦ 1981-82 he became Alexander Van Hambolt Fellow.
- ✦ 1987 Fall season he was Visting Physics Professor at Rochester University.
- ✦ 1988-94 during summer vacations he participated in Faculty Participation Program at Organon National Lab.
- ✦ From 1980 till date he continues to be the Physics Professor at Vanderbilt University.
- ✦ Dr AV Ramayya's research associates are JK Hwang and Ugiyoluvo.
- ✦ Among his graduate students are Dennis Fang, Kelly and Chris Goodin.
- ✦ Guided over 50 students for securing Ph D.
- ✦ Dr Balabadruni Ravi Shankar Babu from India secured



Fullbright Scholarship and worked under Dr AV Ramayya for three years. His publications have been subscribed by over 4000 libraries across the globe. He published more than 100 publications in different journals. His Curriculum Vitae will run into more than 100 pages with list of his publications. There are over 1000 research papers that are very useful for the students and research working in the area of Nuclear Physics.

Fission And Properties Of Neutron-rich Nuclei – Proceedings Of The Sixth International Conference On Icfn6 Hardcover – Import, 16 Nov 2017 by Patrick Talou (Editor), Joseph H Hamilton (Editor), Akunuri Ramayya (Editor).

The above book explain about the research opportunities in the areas of superheavy elements and Nuclear Physics, latest developments and also the kind of researchers that are likely to happen in the future. This book is published once in four years and one such was published in 2017 November 16 for which Dr AV Ramayya was the editor.

Perspective in Nuclear Physics: Proceedings of the International Conference: Paradise Island, Bahamas. Nov 13-17, 1998, dedicated to Akunuri V. Ramayya on the occasion of his 60th birthday.

Mrs Krishnamayi's opinion on Dr AV Ramayya

Nothing is impossible for a “workaholic” like Dr Ramayya, says Mrs Krishnamayi, wife of Ramayya. Talking about her views on this Nuclear Physicist she said: She always considered Dr Ramayya as a very serious scientist all through their 51 years of married life. He goes to lab at 2 am in the morning and travels all over the world on his research work. He has travelled most to Germany. She recalled that in 1982 he spent entire Spring Semester in Germany. Now that both the children are grown up and leading individual lives, she too was now accompanying him



Andhra Viswakala Parishad, Visakhapatnam

on his research trips. She said she enjoyed travelling since she was getting opportunity to see new countries and places. She said her husband was ever enthusiastic about work and would always get excited about working.

Above all, Dr Ramayya and his wife are good hosts and enjoy hosting people who come to various conferences in their city.

Honours & Rewards to Dr AV Ramayya

For a person who is nearing his retirement and aged 80 years, it is great achievement to have American Congressman Jim Cooper felicitate Dr AV Ramayya along with his Vanderbilt University colleague Hamilton for the discovery of 177th Element in the periodic table. Recently, Nashville Indian Association felicitated Dr Ramayya and president of Indian Association of Nashville, Hethal Mehta said, “We happy to have such a product son of India and great scientist amongst us in Nashville. He is such a humble and most common man who inspires many younger people to emulate his simplicity and greatness.”

The Indian Community Senior Support Services also grandly felicitated Dr Ramayya and its founder chairman Dr Pramod Vasudev, said, “Dr Ramayya is very sincere to his work



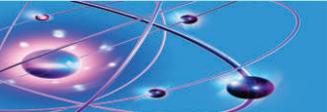
Graduation
at Indiana Univ.
1964

and he is person who gives equal importance to all the things in life. After the death of Dr Ramayya's father, he took the responsibility of the family and helped his brothers develop into individuals. He lives on his terms, with utmost simplicity and love for his work as well as family.”

While working on the discovery of Tennessee, Dr Ramayya, the researcher and experimental scientist, said that since the element was as stable as Oxygen and Helium, it has found place in the periodic table. Talking about the timeline for the discovery, he said, “When people ask me when we complete this research work, I told them in few years. We cannot work on deadline while we are on mission to discover new element.”

After completion of work with the graduate students, Dr Ramayya has set plans for retirement. After the discovery of 117th Element of Periodic Table, all the people associated with this scientist and association wherein he had been participating were very proud and happy. “Despite worldwide recognition for my discovery, there has been no response on my achievement by Indian or Andhra Pradesh government,” Dr Ramayya mentioned.

It is unfortunate that our government have shown a blind on the achievements of Dr Ramayya. His discovery has been written and discussed about in more than 300 publications globally, but there has been no response from Indian government. Only Deccan Herald and Swarajya magazine have written. Swarajya



published a detailed and most exhaustive interview with Dr Ramayya. But all other publications have not tried to write anything about him or his discovery.

Dr Ramayya among Six Influential People in Tennessee State

The Tennessean Editorial Board in 2016 came out with the list of six most influential and prominent people in the state and Dr AV Ramayya was named one among them. In fact both the scientists Dr Hamilton and Dr Ramayya were featured in the list for their discovery of 117th Element in Periodic Table. Both belong to Physics department of Vanderbilt University. Interestingly, the discovered element was named after the state where these belong to – Tennesseine. Dr Hamilton started his career at Vanderbilt in 1958, while Dr Ramayya started teaching at the university from 1965. Dr Hamilton was the director of Oakridge Institute for Heavy Ion Research.

Tennessee representative in American Congress Jim Cooper, former Mayor of Nashville Bill Persel and former Senator Dug Henry, said, “The state is proud of the achievement of Dr Hamilton and Dr Ramayya. The universe is formed with the help of 120 elements and we are proud that one element is named after our state, and reason for this are these two scientists and the entire state is thankful for them.”

There are numerous awards and rewards that have adorned Dr Ramayya, few are:

Fellow of American Physical Society

President of Sigma ray

Member of Division of Nuclear Physics at American Chemical Society

1981-82 he became Alexander Van Humbolt Fellow

Received Honorium from Romanian University.



National Model of Science Award in 20016, prestigious award for his overall contribution to various experimental works in different areas

Best Physics Professor at Vanderbilt University.

Honourary D Sc from Easter Kentucky University in 2009.

In 2010 Guru Ghasi Das Ceentral University awarded Honourary D Sc.

Forman Award Excellence in teaching Physics from Gay and Rebecca organisation

Myneni Gopalakrishna's association with Dr AV Ramayya

Myneni Gopalakrishna, one of the important patrons of Sarasa Bharathi, had his first acquaintance with Dr AV Ramayya at Indiana University, later as Professor at Vanderbilt University. The greatness of Dr Ramayya was such that he suggested Gopalakrishna to take up part-time job at the science library in Vanderbilt University. This laid the foundation for career in librarianship for Gopalakrishna.

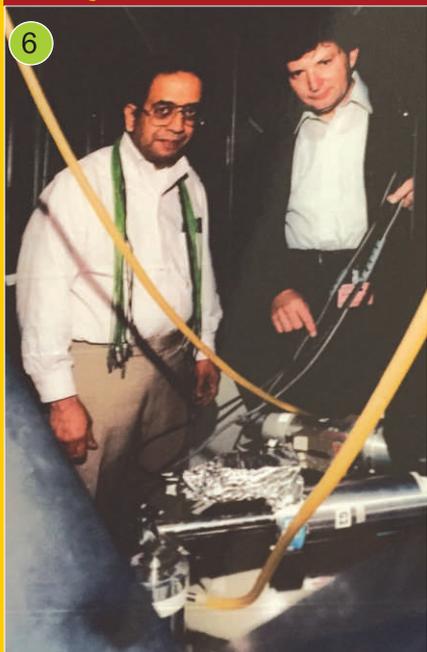
It is indeed inspiring to hear about their association as well as their families bond in their own words: “The first time I met Dr Ramayya was in 1962 when I was planning to return to India. Before leaving America, I wanted to meet a friend. I was told that he was in Indiana University. During my search I landed at Dr Ramayya's office. I was guided by this scientist to meet Kandula Sitharama Sastry (he went on to become thee professor in Physics department of University of Massachusetts) , through him I met my friend.

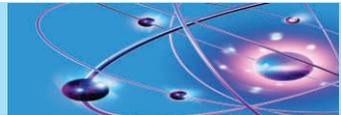
“It was in my second sojourn to America in 1969 that I joined Masters in Library Sciences at Nashville in Tennessee



1. At Oakridge National Lab
2. With Russian Collaborators
- 3 & 4 . Honorary Doctorate at Eastern Kentucky Univ.
5. At Gurugasidas Univ. 2011
6. In the Lab with Dr. Hamilton

Memorable Events





Sri Myneni Gopalakrishna, Smt.Satyavathi with Mr.& Mrs.Ramayya

state. Here I was introduced to Dr Ramayya by my brother-in-law Professor Paruchuri Madhusudan Rao. I passed in A grade in my first term. Without my knowledge, Dr Ramayya recommended me for part time job at Vanderbilt University's science library. He just told me to go and meet the librarian. The librarian immediately said, 'Prof Ramayya has told about you'. Thanks to Dr Ramayya that I was offered job immediately and was given timings so that my studies wouldn't get disturbed.

“Similarly, I got full-time job and after completion of the course I was given a full-time job. Dr Ramayya has been such a kind hearted person that when the science library was under renovation, he recommended me to main university library and got me shifted into it so that I will not have any financial difficulty.

“The Vanderbilt University librarian was popular as editor of Tennessee state libraries magazine. Three months before completion of my Masters course, he recommended me for University of Louisville in Kentucky state. I was appointed as

faculty rank permanent employee. It was the time that student visa rules were also changed and this was the time I brought my wife Satyavati and two sons to the USA, otherwise it would be a difficult task to get them to America.

“I am always thankful to Dr Ramayya for helping me to be financially independent as well as make a career in librarianship. Mrs Krishnamayi was equally courteous and extended all the warmth to us. They invited us for festivals and other gatherings and treated with feast every time. The couple have been always kind-hearted and helpful and I will never forget them.”

Such was the relationship between Myneni and Dr Ramayya family. Even though health was not permitting, Myneni and his wife made it a point to make a trip down to Nashville from Alabama and spent meaningful time with the couple.

Speciality of Nashville

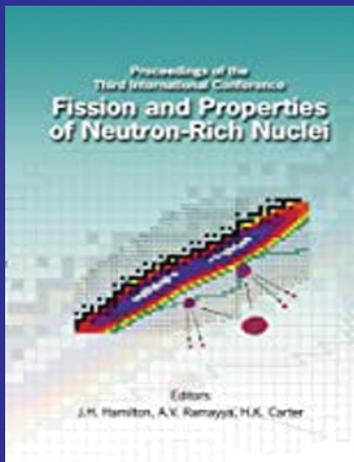
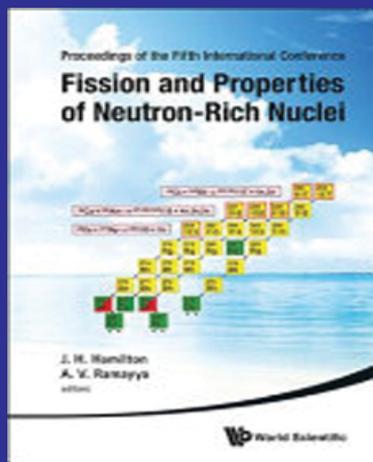
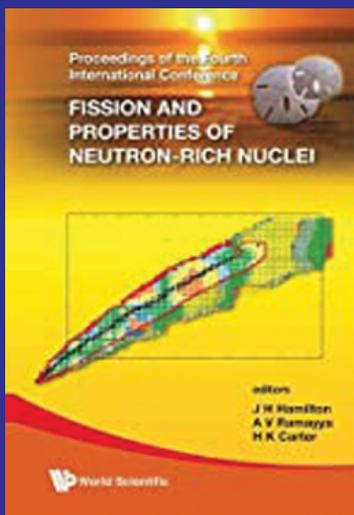
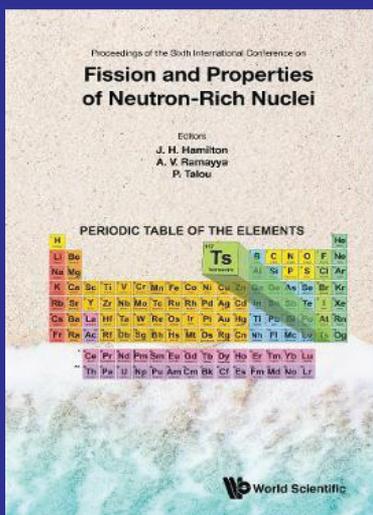
Nuclear Physicist Dr AV Ramayya along with his family live in Nashville in Tennessee state. Nashville, the capital city of the state, has lot of specialities.

The city has been named after Army General Francis Nash in 1779 during American Revaluation.

The city has numerous governments and private academic institutes and is also house of Vanderbilt University which is popular as “Southern Harvard”.

Nashville has been the breeding ground for American country music.

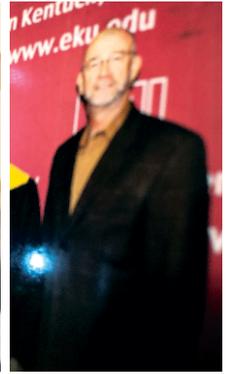
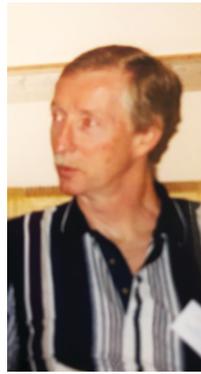
Dr Ramayya, Myneni Gopalakrishna and Paruchuri Madhusudan Rao invited Gnanapeeth Awardee and Padma Vibhushan Dr C Narayana Reddy to Nashville, during his American visit in 1981. It was during that occasion, they also got city Mayor honour Dr C Narayana Reddy as 'one day honorary



Mayor'. During that visit the renowned poet recited his poetry from the book "Karpura Vasantha Rayalu" and Dr Ramayya made it a point to record it on long play recorder. It was later made into a album and his poetry reached many NRIs world over.

Now with Dr Ramayya, scientist from Andhra, living in the city, Nashville has become more popular as the place that helped in the discovery of 117th element in periodic table.

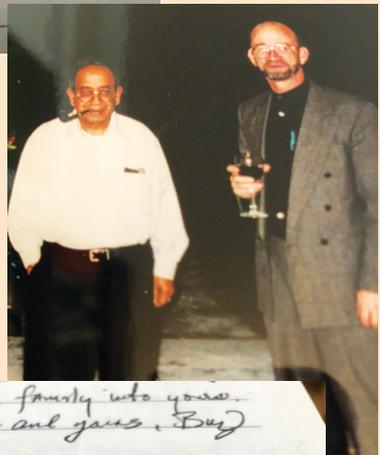
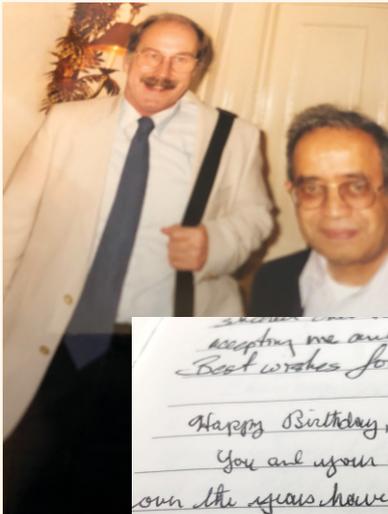
Nuclear Physicist **Dr. Akunuri Venkata Ramayya**



1. Ramayya and Professor Walter Greiner from university of Frankfurt Germany, 2. Professor Lee Reidinger (former student), 3. Professor Rodney Piercey (former student).

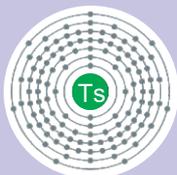
Ramayya,
Happy birthday and thanks for the
warmth and wisdom that you have
shared over the years. And thanks for
accepting me and my family into yours.
Best wishes for you and yours. (Buz)

**Dr. Piercey's
Message**

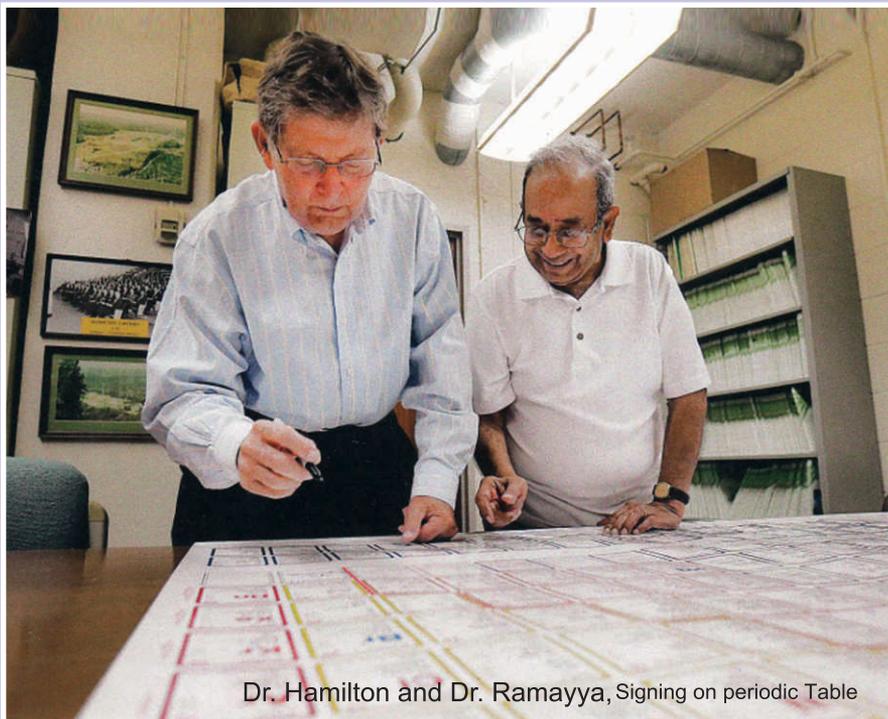


accepting me and my family into yours.
Best wishes for you and yours. (Buz)

Happy Birthday, Ramayya!!
You and your family's friendship and kindness
over the years have meant alot to me. Always
wanting to visit you was like coming home.
Love,
Peggy



Nuclear Physicist Dr. Akunuri Ramayya



Dr. Hamilton and Dr. Ramayya, Signing on periodic Table



Book Dedication Ceremony honoring Prof. Ramayya on his 60th Birth-day on Paradise Island, Bahamas .