

Prof EDWIN GALEA: BSC, Dip.ED, Phd, AMISASI, CMath, FIMA, CEng, MIFireE. Cosmic Theoretician, Mathematical Modeller



Edwin Galea, 1970s. Edwin Richard Galea is an old St Albans High School boy who attended the school during the 1970s. The family was living in Station Street near Oberon Avenue, just up the road from the High School. Edwin's parents, Joseph Galea and Guze Spiteri, were immigrants of Maltese background who settled in St Albans in 1956. Joseph was a gifted mathematician and artist who became a shipwright and served in the naval dockyards in Valletta during the war. He sailed to Australia in 1949 at the age of 23 under the Australian Assisted Passage Migration Scheme. Joseph had trained as a ship builder and was indignant when the first job given him in Australia was as a labourer, so he challenged that decision and soon proved his skills. He worked in Canberra and Sydney before coming to Port Melbourne and later the Williamstown Naval Dockyard where he worked on many Royal Australian

Navy ships, including HMAS Swan.



Joseph and Guze Galea were some of the many British nationals who migrated from Malta to Australia during the 1950s and 1960s. The Maltese Assisted Migration Agreement was arranged in 1948, and by 1952 a total of about 12,000 people had arrived in Australia under the scheme. The peak period of immigration from Malta was in 1954–55 when over 10,000 people came to Australia. There had also been an agreement with the British government because they were closing down the naval bases in Malta and assisting the retrenched people to migrate. The 1954 census recorded 19,988 Maltese

persons in Australia, or 0.22% of the population. In 1986 the figure was 56,233 (0.4%) which was slightly lower than in the previous census. In 1986 there were 4,635 St Albans residents who were born in Malta (9.3% of the population) but it's interesting that 5,972 people were recorded as speaking Maltese at home.

St Albans High School

Edwin Richard Galea must have inherited his father's mathematical aptitude because he took to academia and mathematical modelling in the 1980s before establishing himself in London as a leading international theoretician in fire safety and evacuation dynamics. But that was much later and the early years of schooling occurred locally.

Edwin and his older brother John went to Sacred Heart Primary School, while younger brother Paul went to St. Albans East Primary. Edwin was destined to go to the Marist Brothers College but didn't want to go there, so he was sent to the Technical School because his older brother attended that secondary school. However, after two years Edwin transferred to St Albans High School and was there during the 1970s, being in Form 6 in 1975. His cousins - Stephen, Raymond and Rosemarie Galea - also attended there. By 1980 Edwin was enrolled at Monash

University, where he obtained his Bachelor of Science degree with Honors and also a Bachelor of Education.



Edwin Galea, back row, left, Form 6.2, St Albans High School 1975.

Magnetic Fields and Peculiar Stars

After Monash, Galea moved to New South Wales to study in the Department of Mathematics, Statistics and Computer Science at the University of Newcastle. He completed his PhD in Astrophysics over 4 years. A summary of his work states:



The thesis, entitled Rotating Magnetic Upper Main Sequence Stars, was concerned with the theoretical description of the magnetic fields which occur in a particular class of stars known as Ap stars (the p stands for peculiar). Magnetic fields, like gravitational fields, permeate the entire Universe. The earth has its own magnetic field. It is dipolar in nature and has a surface field strength of about 0.6 gauss, at the poles. The sun has a large scale field up to 10000 gauss. The appearance of sunspots on the solar surface is due to the presence of these strong localised fields. Despite the presence of a magnetic field in the sun it is not classified as a "magnetic star" since at stellar distances its field would go undetected. By far the most numerous of the known magnetic stars are the A stars, which seem to cover the entire stellar surface, range from a few hundred gauss to about 34000 gauss.

In the thesis Dr Galea was concerned with the construction of mathematical models which would describe the structure of the magnetic fields of these stars. The modelling of these stars is complicated by the fact that in addition to proposing a sizeable magnetic field these stars are also rotating. The mathematical description is made more complex in this situation since there is no natural symmetry for the problem. The easiest way to visualize this is to consider a sphere which rotates about some axis while the magnetic field has symmetry about another axis which is at an angle, the obliquity angle, to the axis of rotation. The observational evidence shows that the obliquity angle may assume any value between zero and ninety degrees. Previous theoretical studies on this problem imposed the restriction that the obliquity angle be either zero (aligned model) or ninety degrees (perpendicular model), purely for mathematical convenience. Predictions concerning the magnetic field for the aligned model were at odds with the perpendicular results. Results from the aligned model suggested that the more rapidly rotating the star the smaller the surface magnetic field. The opposite effect occurs in the perpendicular model. Why the two models should produce conflicting results was not understood, nor was it known what could be expected for stars with obliquity angles between the two extreme cases. One suggestion put forward in the literature was that large scale meridional circulation currents in the stellar interior might cause the differences predicted by the two models.



Galea formulated a general model in which the obliquity angle could be varied so that it was a parameter of the model. Thus it was possible to construct models in which the obliquity angle could assume any value from zero to ninety degrees. The mathematical formulation of such problems requires many equations to describe the physical system. These equations can be solved by using numerical techniques which require many hours of computer time. Investigation of these models revealed that a critical obliquity angle exists. Stellar models in which the obliquity angle is less than 55 degrees displays the same trends as the aligned model, while stars in which the obliquity angle was greater than 55 degrees followed perpendicular trends. Galea was able to conclude that the differences between the two model types arise from the geometry of the magnetic field. Some recent observational evidence seems to confirm the finding of Galea in that stars with obliquity angles greater than 55 degrees seem to be rotating quite rapidly and having large surface fields.

Galea was also able to show that meridional currents in the stellar interior merely serve to enhance the differences between magnetic fields whose obliquity angle lies on opposite sides of the critical angle.

After completing his PhD thesis, Galea returned to Melbourne and worked for the BHP Research Laboratory before moving to the UK in 1985 to take up an appointment as a post-doctoral fellow at St Andrews University.

Fire Safety Engineering

Professor Galea is the founding director of the Fire Safety Engineering Group (FSEG) of the University of Greenwich in London where he has worked in the area of Computational Fire Engineering (CFE) research since 1986. FSEG are developers of the EXODUS suite of evacuation software and the SMARTFIRE fire simulation software. He is the author of over 300 academic and professional publications and serves on a number of standards committees

concerned with fire and evacuation for organisations such as; IMO, ISO, BSI and the SFPE Task Group on Human Behaviour in Fire.



Edwin Galea at Greenwich.

He also sits on several UK Government committees concerned with civil defence. He has served on several major Inquires and legal cases as an expert in fire and evacuation including: the Paddington Rail Crash, the Swiss Air MD11 crash, and the Admiral Duncan Pub bombing and assisted the IMO in framing MSC Circ 1033 and 1238. His work is applied to the building, aviation, maritime and rail industries.

Since 1997 Professor Galea has trained over 600 fire and safety professionals from 38 countries in human behaviour, evacuation modelling, fire dynamics and fire modelling through a series of annual short courses he runs at the University of Greenwich. He has successfully supervised 20 PhD and 6 MSc by Research students in fire and evacuation related studies. He is the director for the MSc By Research within the School of Computing and Mathematical Sciences at the University of Greenwich and is a Guest Professor at Ghent University Belgium and the Institut Supérieur des Matériaux et Mécaniques Avancées (ISMANS), Le Mans, France where he teaches on Fire Safety Engineering MSc courses. He is a Visiting Professor at several universities including; Beijing Institute for Labor Protection and the Beijing Chemical University.

Professor Galea has won a number of awards for his work including;

- 1999 and 2002 Hodgson Prize from the Royal Aeronautical Society;
- 2001 British Computer Society Gold Medal,
- 2002 Queen's Anniversary prize,
- 2002 RINA/Lloyds Register Safer Ship Award;
- 2006 Royal Aeronautical Society Gold Award;
- 2008 SFPE Jack Bono Award,
- 2010 Royal Aeronautical Society Bronze Award.

At Buckingham Palace



Edwin Galea and team at Buckingham Palace



Introducing Princess Anne



Introducing colleague to Queen Elizabeth



Edwin and Susan Galea at a Melbourne conference, 1997.

2016 Update

While I have lived in the UK for over 30 years, I still have a soft spot for Melbourne and visit at least once per year, if not for pleasure for business. I have only just returned from a short 10 day visit to Melbourne to attend my father's funeral, who recently passed away at the age of 90. While I was in Melbourne I was given a copy of the St Albans Secondary College's history by a relative and have only just now spent the best part of 4 hours going through it. I hope I will be around for the 70 years celebration as I will make a point of trying to attend.

I currently have several large research projects which have a connection to Melbourne, one is with the DSTO at Fishermans Bend concerned with the RAN and another is a large EU project concerned with wild fires (bush fires) where we are collaborating with Melbourne University, RMIT and the BNHCRC, so I will be travelling to Melbourne quite frequently (I have two more visits later this year).

Also, I recently was featured in a journal which described some of my research (with a focus on my maritime applications of fire and evacuation modelling) and provided a brief history of my life, again with a particular focus on the maritime research component. You may also find this interesting. Finally, my work has featured in many TV documentaries and news programmes. You can find some of these on my youtube page at: <https://www.youtube.com/user/FSEGREsearch> (check out the page headed FSEG TV/Radio Interviews).

Best Regards, and keep up the great work.



Professor Edwin Galea, 2016.

References:

Report about Galea's PhD thesis reproduced from "Cultural Collections, Edwin Galea, the University of Newcastle, Australia - 1985." Source: <https://www.flickr.com/photos/uon/4522109923/>

Information about Fire Safety Engineering Group ref: <http://www2.gre.ac.uk/about/schools/cms/about/staff>

Photographs of Professor Galea and FSEG team at Buckingham Palace: <http://staffweb.cms.gre.ac.uk/~ge03/>

Other photographs courtesy of Galea family.