

# Uncovering treasures of physics: a personal story.

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My invitation requested a presentation with aspects of my journey into physics with some personal notes of some interest to early career researchers. My appreciation of a life in physics has expanded while “piling on the years and still gathering speed” during 60 years in an ever-changing world. Wonderful colleagues enabled contributions while at UNE (Armidale), ANU (Canberra), AAEC (Sydney), Canada (Quebec), USA (San Diego), QUB (Belfast) and UWA (Perth). I will try to convey aspects of excitement, discovery, achievement, friendship, wonderful colleagues, mentors as the treasures of quantum concepts of atoms, molecules and surfaces emerged.

UNE. My undergraduate days at the University of New England broadened my world with living in college, National Service (Army) and student ‘politics’, the latter evolving into National and International Union of Student Vice-President (the travel!) while simultaneously completing MSc studies of the early nanosecond stages of spark channel expansion of interest to welding of metals. My career could have developed in many directions. However further research was encouraged with the ‘hands-on’ challenges of design and construction of apparatus, and the intrigue of high voltage (3kV) double pulsed, electrical discharges in vacuum accompanied by an expanding shock wave with Raleigh-Taylor instabilities.

ANU (Canberra). My PhD studies introduced atomic and molecular hydrogen explorations of ion and neutral particle charge exchange relevant to nuclear fusion processes which captured the imagination for cheap (and instant) energy production. Practical skills were gained during reconstruction of a Morris Minor side-valve engine with essential links to a physics workshop; a new house, marriage and two children. The wisdom of my PhD supervisor, Prof Noel Dunbar, was appreciated for many years; his chosen external examiners formed a life-long friendship and guidance.

AAEC (Sydney), A short lifetime at the Australian Atomic Energy Commission and several years in Quebec (Canada NRC Fellowship) acquired expertise using electron energy analyzers with “cold atoms” while French “multiculturalism” shaped life. Then at Gulf Atomic (San Diego, where Australia’s only nuclear reactor was built), a world of industrial research opened.

San Diego expanded life at 32° North on the Californian West Coast. Electron scattering from atomic hydrogen showed the early stages of threshold excitation, resonances, surface and atmospheric physics with AFOSR and ARPA funding.

QUB (Belfast, UK). The flowers bloomed with experimental plantings and theoretical nurture. That combination was exciting, memorable and most enjoyable. About 20 papers launched careers, with hydrogen reaching atomic dimensions [1,2,3]. The electron scattering observations kept pace with advances in technology, physics, mathematics and computing while the excitement of experimental and theoretical practicalities kept pace with one another, although a slight advance in either usually met with appropriate responses from the other. Life in Belfast was enjoyed with many opportunities. The concept of non-locality and its applicability to quantum phenomena, and life, was without challenge.

UWA (Perth) from 1980, as Professor of Physics, enabled a new direction with spin-polarised electrons; the thrust of experimental research continued and revealed many facets of quantum electron correlations in atoms, thin films, their interfaces and surfaces. The strategic advantages as the only member of academic staff in Physics with a graduate teaching degree have led, hopefully, to encouragement to teach science, engineering, maths and physics.

The ability and funding to build instrumentation that was designed to identify specific quantum phenomena and with appropriate sensitivity has been very exciting and rewarding as the intertwining of electron exchange, spin orbit interaction and symmetries increase our understanding of quantum phenomena, new materials and their applications. Some exciting recent results will be presented; they indicate the aspirations and achievements of others.

## References

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