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Pulsar Astrophysics: The Next 50 Years

Edited by

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PULSAR ASTROPHYSICS
THE NEXT FIFTY YEARS
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COVER ILLUSTRATION:

“Cosmic Lighthouses” - An artist’s impression of a pulsar, a highly-magnetized, rotating neutron star, overlaid by the IAUS 337 logo celebrating 50 years since the discovery of the first pulsar.

Credit: Jurik Peter (image), David Webb (logo)

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SEPTEMBER 4–8, 2017

Edited by

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Preface

Ever since the discovery in 1967 pulsars and neutron stars have provided an unprecedented opportunity to study the extremes of physics. This started with the very rapid identification of pulsars as rotating neutron stars with extremely strong magnetic fields and, selecting just a few highlights from the following decades, was followed by the discovery of the Hulse-Taylor binary, millisecond pulsars, the first pulsars in globular clusters, the pulsar planets and the double pulsar. In the last decade alone we have had some amazing discoveries and science with an impact across all astronomy: a pulsar in a triple system that promises to be the best test environment for the strong equivalence principle; a magnetar located in the Galactic Centre giving us a new view on these environs; more than 100 pulsars found to be emitting gamma-ray emission, including many millisecond pulsars, some of which are seen exclusively at gamma-ray energies; pulsars which are transitioning on short timescales between being millisecond radio pulsars and low-mass X-ray binaries; sub-100-nanosecond timing precision achieved on a handful of pulsars; a 2 solar mass neutron star in a relativistic binary system which strongly constrains alternatives to the general theory of relativity and dense-matter equations of state. It is clear that the pulsar and neutron star world is thriving!

2017 marks the 50th anniversary of the discovery of pulsars and is thus an excellent moment to reflect on what we have learnt from these remarkable physical laboratories and to cast our eyes forward to the exciting opportunities they provide for physical and astrophysical studies in the coming decades. This look forward to the future is essential as the continuous improvement of current facilities and the building of superb new facilities promise decades of exciting (astro-)physics to follow. This formed the rationale to organise IAU Symposium 337 – Pulsar Astrophysics: The Next Fifty Years.

The Symposium was hosted at the Jodrell Bank Observatory, the site of the iconic Lovell Telescope, eMerlin and the SKA international headquarters and the award winning Jodrell Bank Discovery Centre. The Lovell Telescope, the third largest steerable telescope in the world, has been observing pulsars for the entire 50 years and seamlessly connects the past, present and future of pulsar research having been involved in the field back to within just a few months of their discovery and still contributing to deliver cutting edge research.

We were delighted to welcome over two hundred members of the pulsar family from all over the world. There were contributions covering topics such as “Current and Next Generation Pulsar Surveys”, “Gravity tests with pulsars”, “Gravitational Wave science with pulsar timing arrays”, “Neutron Star Masses, Glitches and Equations of State”, “The Neutron Star Zoo”, “The multi-messenger view of Pulsars”, “Pulsar emission physics across the electromagnetic spectrum”, “Neutron Star Binaries”, “Constraining the magneto-ionic properties of the ISM and local IGM using pulsars” and “The future of pulsar research and facilities”. These excellent contributions included 17 invited talks, 74 contributed talks and 91 posters. The participants not only brought these exciting scientific contributions, but also a wonderful atmosphere.

We would like to acknowledge the financial support of our sponsors. But foremost we would like to acknowledge the hard work of the members of the Jodrell Bank Centre for Astrophysics and the Discovery Centre who made the Symposium possible and made it a worthy celebration of 50 years of pulsars.

*The LOC & SOC
Manchester, September 14, 2017*

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Acknowledgements

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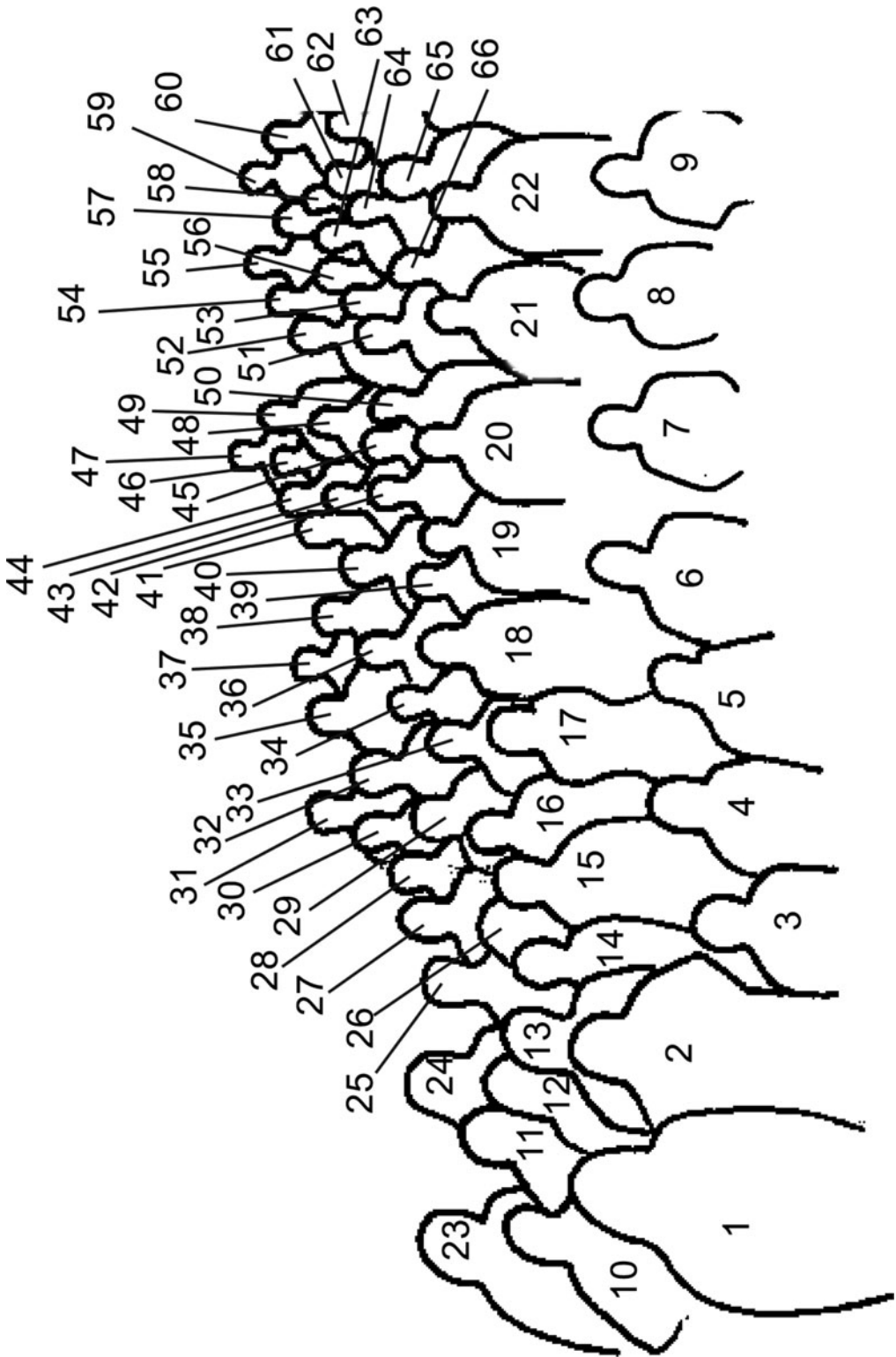
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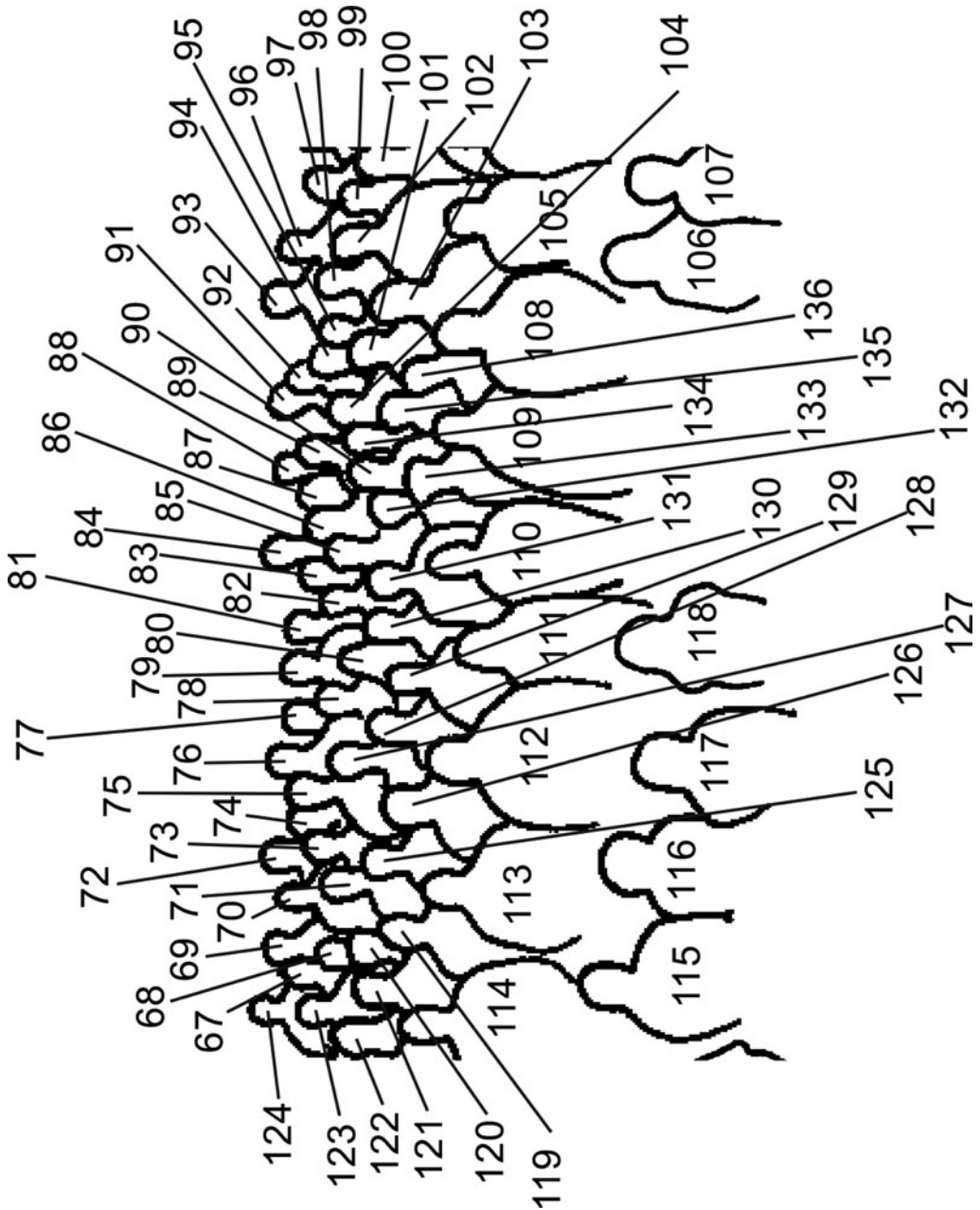
Pulsar Astrophysics: The Next Fifty Years

IAU Symposium 337 - 4th-8th September 2017 - Jodrell Bank Observatory, University of Manchester

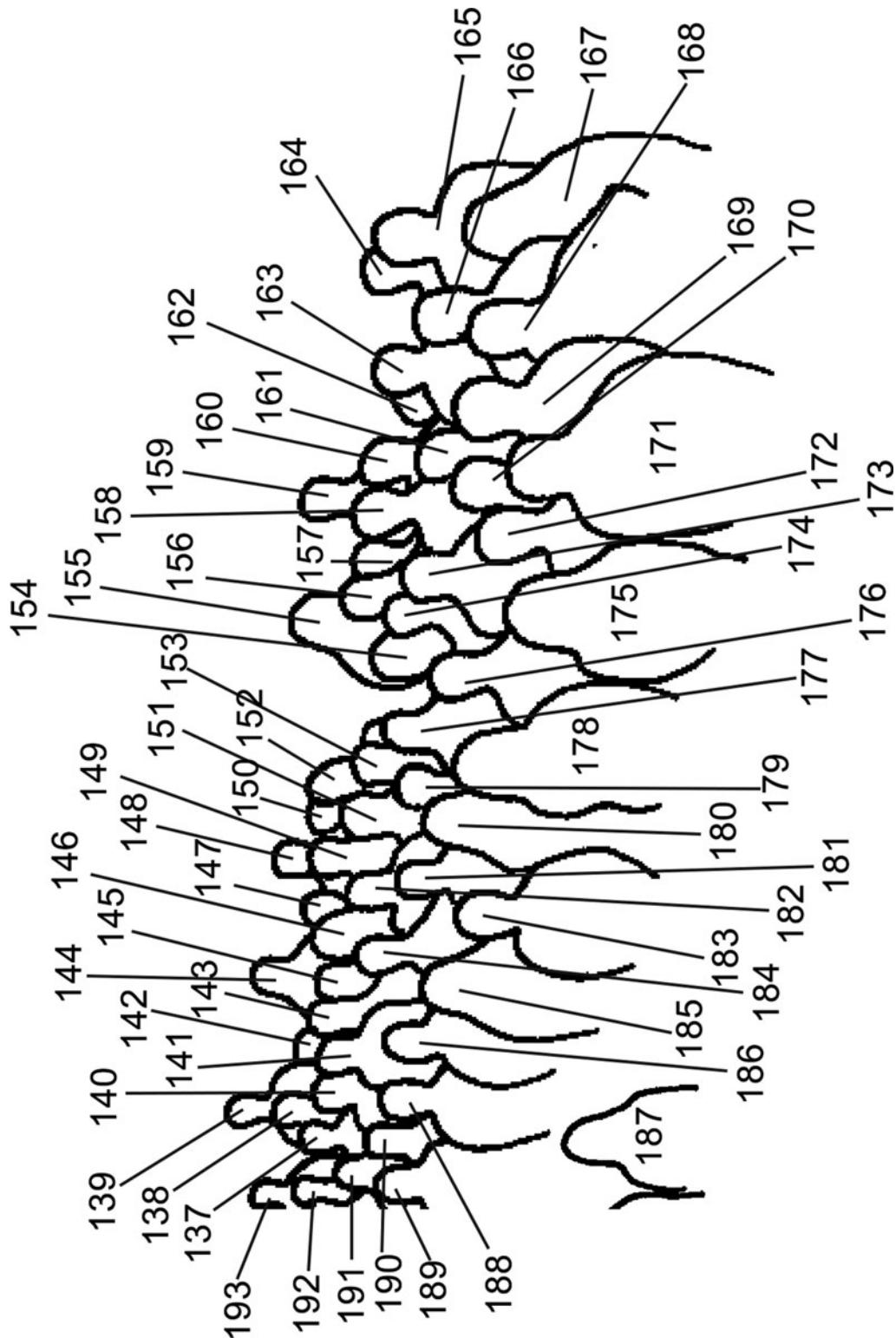
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To commemorate the anniversary of the discovery of pulsars and the symposium a sustainable, permanent memorial in the form of a Crab Apple tree, *Malus 'White Star'* was planted near the Lovell telescope by Dame Jocelyn Bell-Burnell. At the same location each of the participants in the meeting were invited to plant a Daffodil, *Narcissus 'Woodland Star'* as their own memorial to the meeting and anniversary.



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The Pulsar Academic Tree

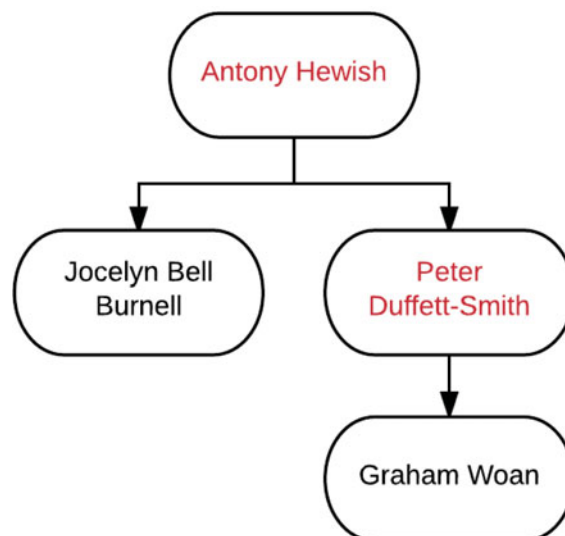
This conference celebrates the past 50 years of pulsar discovery and looks forward to the next 50 years. In the first half century of research, many astronomers have become active in this field of astronomy. At this conference we collected data by asking the participants of the symposium to trace the pulsar academic tree and how the knowledge of pulsars has spread across the globe since the initial discovery in Cambridge, UK.

The following figures show the academic pulsar trees, starting with the discovery of pulsars by Jocelyn Bell Burnell in Cambridge in 1967 in Tree Number 1. In all figures, supervisors that are important to the structure of a tree but did not attend the conference are displayed in red text. Attendees that were in a tree of 2 or less are not shown.

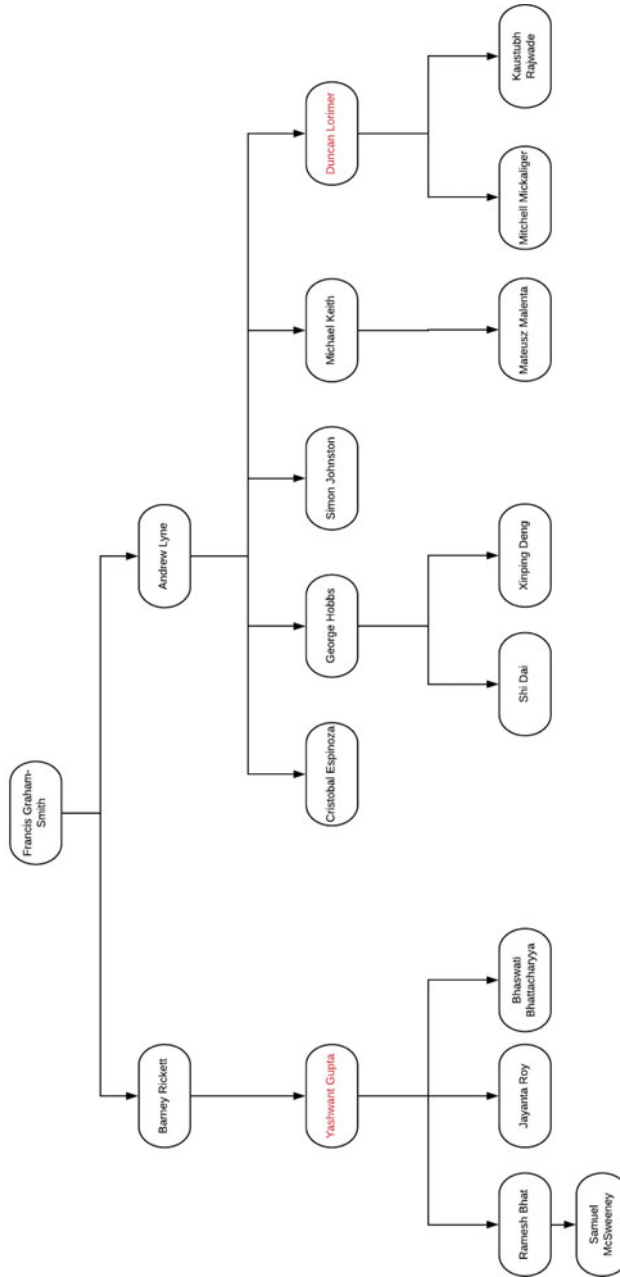
Jocelyn Bell Burnell's supervisor was Antony Hewish who is shown also in Tree Number 1. He worked closely with Martin Ryle (not shown) who was the supervisor of Sir Francis Graham Smith who also did his PhD in Cambridge. Francis Graham Smith later went on to work at Jodrell Bank and was the supervisor to Andrew Lyne and Barney Rickett shown in Tree Number 2 and the students they went on to supervise. Francis Graham Smith worked at Jodrell Bank under the then Director Sir Bernard Lovell. Lovell was supervisor to Clifton Ellyett (Tree Number 3) and Alan Maxwell (Tree Number 4) with Australian and Canadian roots respectively.

Pulsar research spread across the globe with prominent groups in Germany, the Netherlands, Italy, America, India and China, shown in the remaining Trees. We stress that this tree reflects the view of the participants of IAUS 337, not the view of the pulsar community as a whole.

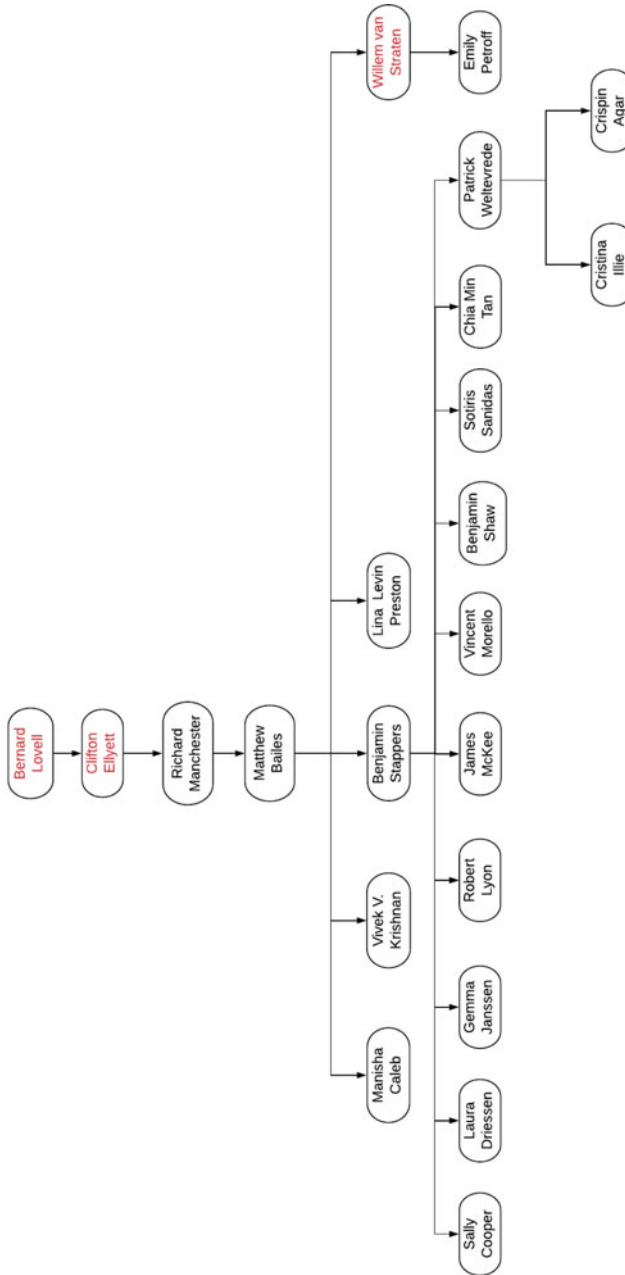
Acknowledgements: Thanks for Sally E. Cooper for compiling the pulsar academic tree.



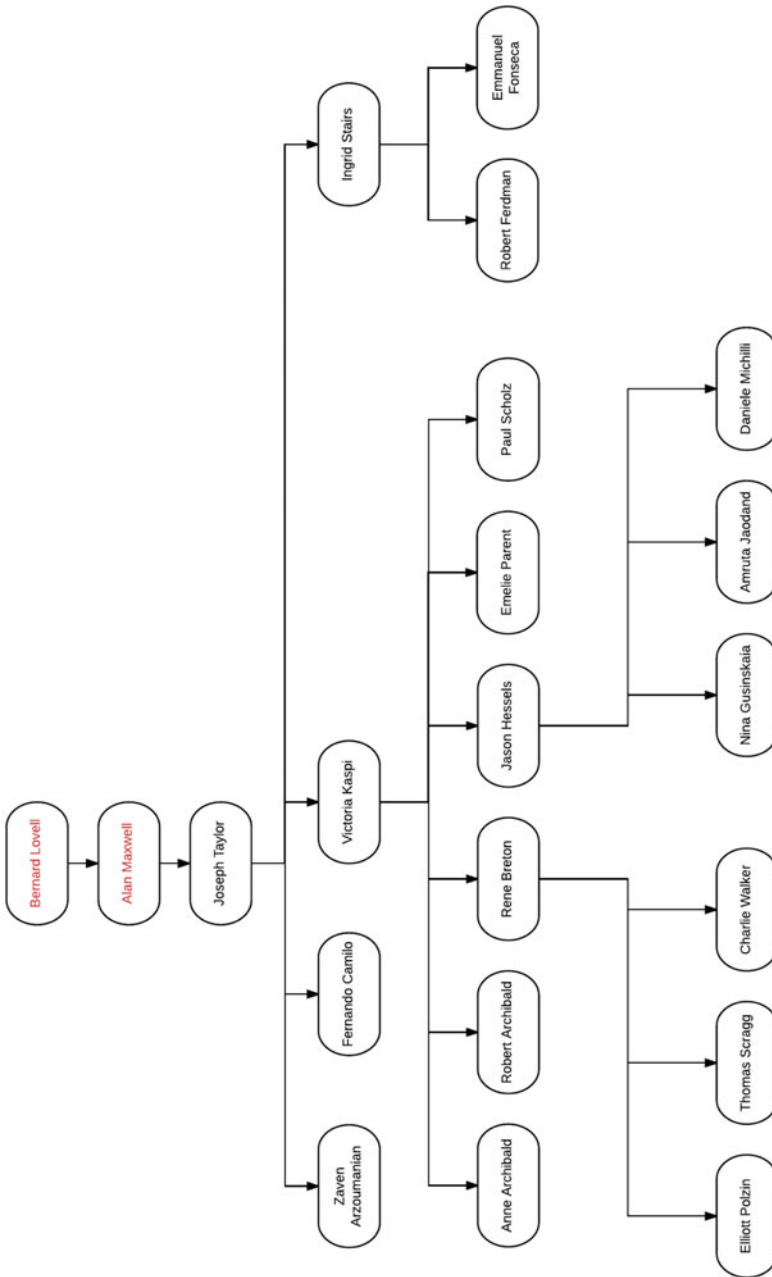
Tree Number 1.



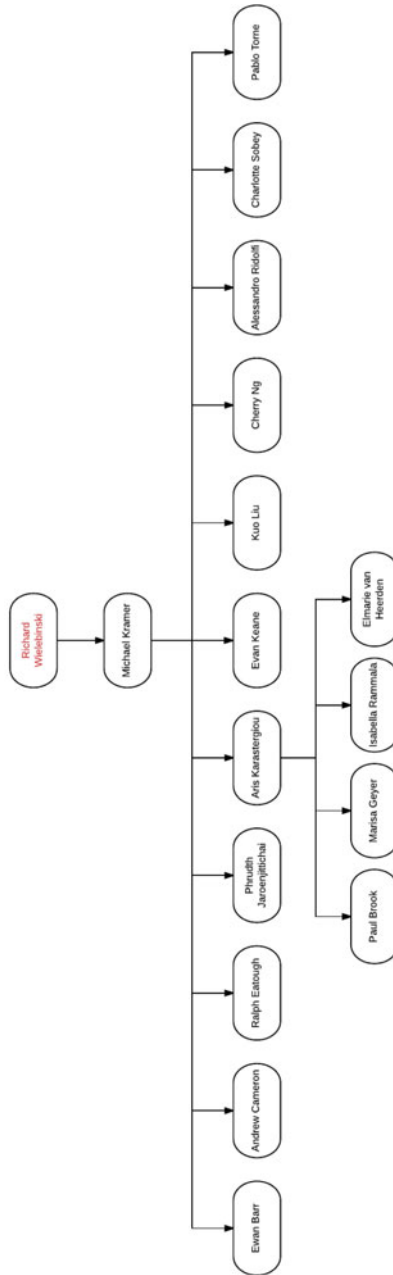
Tree Number 2.



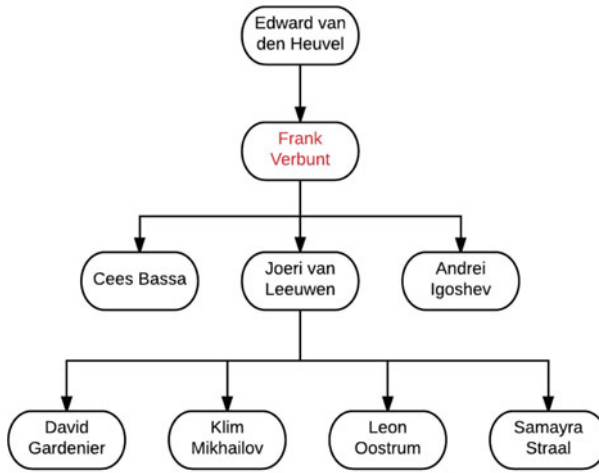
Tree Number 3.



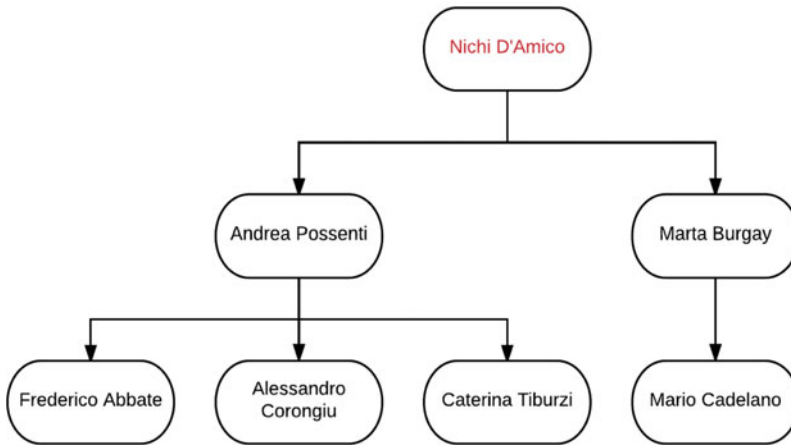
Tree Number 4. This tree is connected to Tree Number 3 through Bernard Lovell.



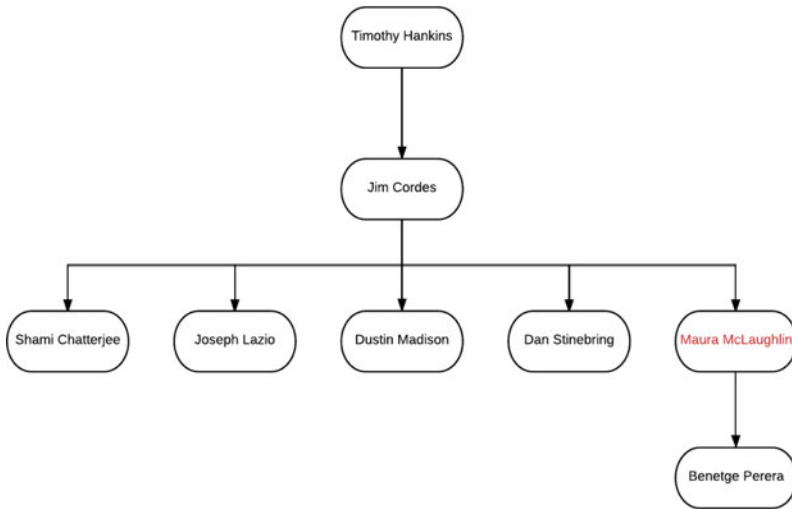
Tree Number 5.



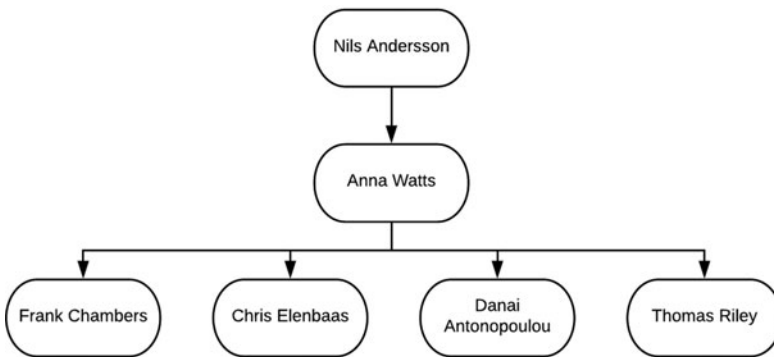
Tree Number 6.



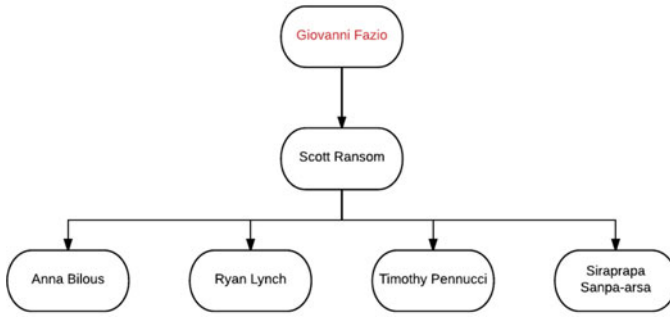
Tree Number 7.



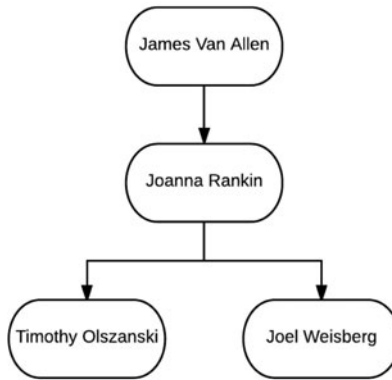
Tree Number 8.



Tree Number 9.



Tree Number 10.



Tree Number 11.