The book has detailed discussions on ring dust, radiation environments, ring origins, and computer simulations. The relationship between planetary rings and other astronomical ring systems such as pre-planetary nebulae and galactic discs is investigated. Reasons are given for the gaps and sharp edges.

This book is a tour de force which emphasizes the fact that not only are planetary rings one of the most beautiful phenomena in our subject they are also one of the most physically and dynamically challenging. And still we are not sure whether they are just remnants of the initial planetary-formation process, or were produced at a later time when some unfortunate satellite was ripped apart after being perturbed inside the Roche limit. And even though we have a good idea of what is on the surfaces of the ring particles, their interiors are still mysteriously hidden. And best of all we still have the problem of estimating the ring mass and longevity. As with many planetary objects, we now know a lot but there is still a huge amount to find out. This book is a great encouragement to those starting out on the investigation. — DAVID W. HUGHES.

A TRIBUTE TO DONALD LYNDEN-BELL

GIVEN AT THE MEMORIAL SERVICE, CLARE COLLEGE CAMBRIDGE,
2018 JUNE 22

By Ofer Lahav
University College London

It is an honour to pay this tribute to Professor Donald Lynden-Bell FRS CBE. He co-supervised me in Cambridge for my PhD in 1985–1988, and later I had the privilege to be his colleague at the Institute of Astronomy for many years. We also kept in touch after I moved to UCL. Last year I saw Donald and Ruth* at conferences in both Pune (India) and in Jerusalem (Israel). The always-energetic Donald was in his prime at those meetings, giving excellent talks, asking as usual clever probing questions in his distinct voice, and having stimulating conversations with all participants, junior and senior.

Donald was born on 5 April 1935 in Dover Castle. By a cosmic coincidence I was also born on 5 April (in Israel), and over many years we congratulated each other on that day (with Donald reminding me it is the end of the tax year!).

Donald’s father was a military officer. He was with Field Marshall Edmund Allenby in 1917, when the British Army was taking over Palestine from the Ottoman Empire. He returned to the then-Palestine in the early 1930s, for another commanding role. When travelling with Donald across Israel I was impressed by his knowledge of the country, from biblical stories to the present-day complicated politics of the region.

* Ruth Lynden-Bell FRS is Emeritus Professor of Chemistry at Queen’s University Belfast.
Donald’s ‘academic father’ was the late Leon Mestel, who told me once that Donald was very independent as a PhD student. Donald made seminal contributions to astrophysics over six decades, among them the following major two: his 1962 paper (with Olin Eggen and Allan Sandage) proposed that our Galaxy (the Milky Way) originated through the collapse of a single large gas cloud. This has led to numerous other theoretical studies and experiments, including the Gaia satellite, which just released its recent excellent data; and in 1969 Donald hypothesized that quasars are powered by massive black holes accreting material, suggesting that most massive galaxies have black holes at their cores. This is currently our best understanding of those energetic objects. That work was recognized by the inaugural Kavli Prize for Astrophysics (jointly with Maarten Schmidt) in 2008. Other well-known studies by Donald include the highly creative ideas of ‘Negative Heat Capacity’ and the gravitational process he called ‘Violent Relaxation’ (what a poetic combination of those two words!).

My very first meeting with Donald was in the early 1980s. He visited his long-term collaborator Joseph Katz at the Hebrew University and gave an inspiring talk about the ‘Mass of the Local Group of galaxies’ at a conference there*. In September 1985 I arrived in Cambridge. My original PhD project† got ‘side-tracked’ by a conversation with Donald in one of the Institute of Astronomy morning coffee breaks.

He mentioned to me that he was part of a team of seven astronomers that later became known as the ‘7 Samurai’, who were studying the motions of 400 elliptical galaxies relative to the overall expansion of the Universe§. The 7 Samurai found that those galaxies share a motion towards a hypothetical clump of mass. Donald asked me to help him to create a galaxy map by merging three catalogues. It revealed a major concentration of galaxies, about 200 million light years away. We were so excited to see this ‘Great Attractor’ in full glory. The plot made it to the Lynden-Bell et al. (1988) paper and even to the cover of the New York Times!

Donald and I continued to exploit these maps, to figure out what is causing the motion of our Galaxy with respect to the Cosmic Microwave Background. After 30 years, the ‘Great Attractor’ still features in galaxy maps, but it is understood to be part of a larger network of clusters, filaments, and voids, called the Cosmic Web. At the same time Donald supervised other students§ on a wide range of other topics, from Galactic Dynamics to General Relativity.

* Recently I revisited with students this mass estimate of the Local Group in the presence of Dark Energy, and had stimulating discussions with Donald about it.

† I started my PhD project with George Efstathiou on galaxy formation, which seemed a natural extension of my Masters project with Jacob Bekenstein. George Efstathiou succeeded Donald as the Professor of Astrophysics.

§ The ‘7 Samurai’ were: Dave Burstein, Roger Davies, Alan Dressler, Sandy Faber, Donald Lynden-Bell, Roberto Terlevich, and Gary Wegner.

§ Among Donald’s students that time were Wyn Evans (galactic dynamics), Jose Lemos (General Relativity) and Somak Raychaudhury (galaxy motions). At present they are Professors in Cambridge, Lisbon, and Pune, respectively.
Donald’s research style was unique. He loved mathematics, and his blackboard and notebooks were always full of equations. I recall numerous sessions with him by the blackboard in his previous office at the Observatory building, which served earlier as Sir Arthur Eddington’s dining room. Donald said once to a student that “a day without a calculation is a wasted day!” At the same time he really wanted to understand Nature, so mathematics was his tool to achieve that.

In an article in *Annual Reviews of Astronomy and Astrophysics* (2010) he reflected on the big questions of the field and on how to address them: “The great challenges for future astronomers will be the exploration of the 96% of the Universe now believed to be neither atomic nor baryonic but perhaps partially leptonic. However, most advances do not come via frontal attack but from ‘bread-and-butter’ investigations in related areas where observation is possible today!”

Donald served as Director of the Institute of Astronomy and as President of the Royal Astronomical Society, inspiring in these roles the work of others and promoting careers of many young researchers. A conference was held in 1995 for Donald’s 60th Birthday, with the dinner hosted here at Clare College, and a conference book published by Cambridge University Press*. But it was only a ‘mid-term’ summary of his work, as Donald continued his highly creative research for 22 more years, until last December†.

On a personal level, Donald was warm and generous, and cared a lot about his students and colleagues. One of his many admirers told me the other day: “Donald’s curiosity may have led to his fearsome questioning, but he was always inspiring. You always knew when you had been in a discussion with Donald!”

Donald was delighted to see his granddaughter Helen starting her Natural Sciences degree this year in Cambridge.

In recent years Donald became a movie star! The film *Star Men*‡ features Donald and three colleagues, Roger Griffin, Wal Sargent and Nick Woolf, on their 50th-reunion hike. It gives an insight into Donald’s perspective on life, science, and religion. He was proud of the film and seeing his work appreciated that way outside academia.

Donald passed away peacefully at home on 2018 February 6, and his funeral took place on February 20 at St Edward’s Church and was followed by a reception at Clare College. Today’s memorial service is a great opportunity to celebrate Donald’s life and his remarkable scientific achievements in understanding our cosmos. He inspired generations of astronomers, and those of us who were lucky to work with him will do our best to pass on Donald’s spirit to our students and to our children.

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†His last paper, with Kumar Chitre, on the entropy of the Universe, was published in *The Observatory* (138, 1, 2018). Donald published regularly in this *Magazine* and served as its Editor in 1967–1969.

‡The film’s director is Alison Rose.