

Essay-Contest 2017/18

Leon Ritterbach, International School Kufstein, 9. Schulstufe, Fremdsprachenerwerb: 5 Jahre

Scott Duncan Tremaine

Astrophysics is a very interesting field of science. You explore the whole universe, from tiny Asteroids to huge black holes. Every time you solve one of the mind breaking riddles that the universe has to offer, it raises new questions. You can find out how the universe works and how forces like gravity form the universe we know and act on us. Scott Duncan Tremaine is one of the people who were lucky enough to be able to study astrophysics. Today, he is 68 years old and one of the world's leading astrophysicists. He is a fellow of the Royal Society and a member of the National Academy of Sciences. He made predictions about planetary rings, has written an outstanding book "Galactic Dynamics" and named the Kuiper belt. Scott Tremaine's research is focused on the dynamics of a wide range of astrophysical systems, including planetary rings, comets, planetary systems, galaxies, and clusters of galaxies (structures that consists of anywhere from hundreds to thousands of galaxies). He is known for his contributions to the theory of Solar Systems, Galactic Dynamics and his prediction of small moons keeping the belts of planets in place. Tremaine is so popular that there is even an asteroid named after him, 3806 Tremaine. (Canada under the stars/ 2007), (Princeton University, Department of astrophysical sciences, 2018), (Perimeter Institute for Theoretical Physics/ 2012), (National Academy of Sciences/ 2002), (The Royal Society/ 1994), (Scott Tremaine - Video Learning - WizScience.com/ 2015), (IAS/ 2018)

Tremaine grew up in Toronto. He never liked subjects where he had to memorize things, like in history. Scott always preferred Maths and Physics. Once he understood the topic, he didn't have to remember everything. He decided to study Physics and got his bachelor's degree at McMaster University in 1971, his PhD at Princeton University four years later. During the 1970s, he studied the rings of Saturn and Uranus while at California Institute of Technology, but more on that later on. For ten years, he was the first director of the Canadian Institute for Theoretical Astrophysics (also called CITA) at the University of Toronto. After that he received the chair of the Astrophysical Sciences department at Princeton University. In 2007 he left Princeton to become the Richard Black Professor of

Astrophysics at the Institute of Advanced Study, where he is still working today. Of course, he has won several awards during his career, one of them being the Dannie Heineman Prize for Astrophysics of 1997, a major international award. (Canada under the stars/ 2007), (Math4Science/ 2016), (Perimeter Institute for Theoretical Physics/ 2012), (Scott Tremaine - Video Learning - WizScience.com/ 2015), (IAS/ 2018)

As I have already mentioned, Tremaine studied the rings of Saturn and Uranus in the 1970s. While he was studying, he found out that collisions between ice chunks, which are orbiting the planets in these rings, should cause the rings to spread out. However, they don't. Then in 1979 Scott, together with Peter Goldreich, predicted that the Rings of Saturn and Uranus are held in place by small moons. They also predicted that there are density waves in Saturn's rings. At first, many Astronomers were sceptical about it. In 1981, two years after the prediction, the Saturnian moons Prometheus and Pandora were discovered. Another five years later the Voyager 2 spacecraft flew past Uranus and confirmed the prediction. This turned out to be a high point in Tremaine's career. The next high point, his first book *Galactic Dynamics*, soon followed. Tremaine wrote it together with James Binney, who is also a fellow of the Royal Society, in the year 1987, and it quickly became a reference work in the field. The book's nickname is "the Bible of galactic dynamics" and it is used by students as well as researchers. The book describes our present understanding of the structure and dynamics of stellar systems such as galaxies and star clusters (basically big groups of stars). (Canada under the stars/ 2007), (IAS/ 2018), (Math4Science/ 2016), (Google Books – Galactic Dynamics/ 2018)

Tremaine and two other Canadian Astrophysicists confirmed the existence of the Kuiper belt (a belt of astrophysical objects like comets) using some computer simulations. With those computer simulations, the team was able to show that the comets we see can't just come from the Oort cloud. They also came up with a theory about a cloud of comets which surrounds the sun at a distance of about 1.6 lightyears, so it is much farther away from the sun than the outer planets and the Kuiper belt. At that time, it was thought that most of the comets we see originate in the Oort cloud. Using this theory, the team were able to prove

the predictions the astronomer Julio Fernández made in an article published in Monthly Notices of the Royal Astronomical Society in 1980,, which stated that a comet belt would be required because the number of comets seen didn't match up with the number of comets possible. After the team of three proved Fernández' prediction, Scott named the comet belt Kuiper belt, because Fernández wrote the word Kuiper as well as the words comet belt in his first sentence of his article. It is located in the outer Solar System, extending from the orbit of Neptune. (Canada under the stars/ 2007), (English Oxford Living Dictionaries/ 2018), (IAS/ 2018), (The Royal Society/ 1994)

Thanks to Tremaine's research, we are able to understand the universe a little bit better. He made big contributions to the field of Astrophysics with his predictions about planetary rings and disks, which are now proven, and with his theory about Galactic Dynamics. The students who learned from him in the past or will learn from him in the future should be thankful to have the opportunity to learn from one of the world's leading Astrophysicists. I have always been interested in Astrophysics, Astronomy and basically all things that have to do with the universe. Learning so much about a great astrophysicist has only increased my interest. (Canada under the stars/ 2007), (IAS/ 2018)

Sources:

- <https://web.astro.princeton.edu/people/scott-d-tremaine>
- <https://www.sns.ias.edu/tremaine/Other-Publications>
- <https://www.youtube.com/watch?v=LnAvvXN-iGo>
- <http://adsabs.harvard.edu/abs/1987gady.book.....B>
- https://en.wikipedia.org/wiki/Scott_Tremaine
- <https://www.ias.edu/scholars/tremaine>
- https://de.wikipedia.org/wiki/Scott_Tremaine
- <https://www.perimeterinstitute.ca/people/scott-tremaine>
- <http://www.nasonline.org/member-directory/members/49681.html>
- <https://royalsociety.org/people/scott-tremaine-12434/>
- http://astro-canada.ca/scott_duncan_tremaine-eng
- <http://math4science.org/scott-tremaine/>
- https://en.wikipedia.org/wiki/Kuiper_belt
- <https://de.wikipedia.org/wiki/Kuiperg%C3%BCrtel>
- https://en.wikipedia.org/wiki/Galaxy_cluster
- https://books.google.at/books/about/Galactic_Dynamics.html?id=01yNf7mipb0C&redir_esc=y

- https://en.wikipedia.org/wiki/Star_cluster
- https://en.wikipedia.org/wiki/Oort_cloud
- https://de.wikipedia.org/wiki/Oortsche_Wolke