

# Gravitational waves: Astrophysics Final Frontier

**Prof. Marco Cavaglia**  
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**Chemistry  
Seminar on  
Gravitational  
Waves**

**4:00 p.m.  
Monday  
April 19  
Via Zoom**

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**Abstract:** In 1916 Albert Einstein published a paper demonstrating that space and time can be warped in the shape of a wave. One hundred years later, scientists from the Laser Interferometer Gravitational-wave Observatory (LIGO) Scientific Collaboration and the Virgo Collaboration announced the first observation of a "ripple of space-time" from two colliding black holes. This scientific achievement marked the beginning of a new way of exploring the "dark side" of our Universe. Less than two years later, LIGO and Virgo scientists detected gravitational waves from the collision of two neutron stars, an event rapidly followed by the observation of light in all regions of the electromagnetic spectrum by hundreds of telescopes around the world and space in what became the most observed cosmic event in the history of humankind.

Gravitational-wave observations are a new way to explore the sky and uncover the Universe's deepest mysteries. They allow scientists to test Einstein's General Relativity under extreme-gravity conditions, get important clues on the structure of dead stars, understand the origin of matter and the evolution of the Universe. With routine detections of gravitational waves, we can now map the dark universe. How many black holes populate the sky? How do they form and merge? What is the origin of the heavy elements? Is General Relativity the correct theory of gravity? These are just a few of the unanswered questions that gravitational-wave astronomy is helping to answer.

**About the speaker:** Marco Cavaglia is Professor of Physics at Missouri S&T. A native of Italy, he earned a Ph.D. in Astrophysics at the International School for Advanced Studies in Trieste. Before joining the faculty at Missouri S&T, he held a position as Asst. Professor, Associate Professor and Professor at the University of Mississippi in (2004-2018). Previously, he was a research scientist at Tufts University, the Albert Einstein Institut in Germany, the University of Beira Interior in Portugal, the Massachusetts Institute of Technology, and Lecturer at the University of Portsmouth, UK. During his career, Dr. Cavaglia authored over 240 publications in peer-reviewed journals and has been the recipient of research awards for over \$3M. His scientific interests are in gravitational physics, astrophysics, theoretical physics, and education and public outreach. Dr. Cavaglia has been a member of the Laser Interferometer Gravitational-wave Observatory Scientific Collaboration (LSC) since 2007. With more than 20 years experience in management and administration of scientific units, he served from 2012 to 2017 as Assistant Spokesperson of the LSC, an organization of over twelve hundred scientists from over 100 institutions across 20 countries. From 2008 to 2012 he was founding chair of the LSC education and public outreach Group and from 2012 to 2015 he was founding chair of the LSC diversity group. He is a member of the American Physical Society and the International Astronomical Union, and serves as elected co-chair of the LSC Burst Source Working Group. Cavaglia shares with his LSC colleagues several other recognitions, including the 2016 Special Breakthrough Prize for the detection of gravitational waves and the 2017 Princess of Asturias Award for Technical and Scientific Research.