DEPARTMENT OF
PHYSICS &
ASTRONOMY

Physics & Astronomy
Colloquium

Prof. Priyamvada Natarajan

(host: Prof. Tom Maccarone)

Yale University

3:30 - 4:30 p.m. | Tuesday, Oct. 7

ESB I Building 120

Title: New Insights into the formation of the first black holes

Abstract: A revolution is underway in our understanding of the origins of supermassive black holes (SMBHs), reshaping our view of how the very first black holes formed and grew in the early universe. New breakthroughs have provided critical insights into their seeding channels, mass assembly histories, and coupling to their host galaxies. In particular, evidence for direct collapse as a viable pathway to forming massive black hole seeds has been illuminated by the combined capabilities of JWST, Chandra, and Hubble. At the same time, observations of gravitational wave backgrounds and advances in computational modeling are revealing complementary channels for SMBH growth through accretion and mergers. In this talk, I will highlight new insights into black hole formation during the first 400–500 Myr after the Big Bang, explore the relative roles of competing seeding mechanisms—including light seeds from Population III remnants and heavy seeds from direct collapse—and discuss how current and upcoming observations are beginning to discriminate between them. I will conclude by outlining the key open questions in black hole formation physics and the exciting prospects ahead, including constraints from the LISA mission.

PROFESSIONAL + PERSONAL BIO

Priyamvada Natarajan is an astrophysicist, and the inaugural Joseph S. and Sophia S. Fruton Professor in Astronomy & Physics at Yale and an external PI at Harvard's Black Hole Initiative. She has made seminal contributions to our understanding of the nature of dark matter using gravitational lensing studies; and the assembly history of supermassive black holes over cosmic time. The recipient of many awards and honors, including fellowships of the American Physical Society; American Astronomical Society; the American Academy of Arts and Sciences; the American Association for the Advancement of Science; the Guggenheim and Radcliffe Fellowships, she was recognized with the 2022 Liberty Science Center 'Genius Award' and 2025 Dannie Heineman Prize in Astrophysics that is jointly awarded by the American Astronomical Society and American Institute of Physics. She was included in the TIME100 list of most influential people in the world in 2024 for her path breaking contributions to Astrophysics. Priya has served as Chair of the National Astronomy and Astrophysics Advisory Committee that advises NASA, NSF and DoE; as Chair of the Division of Astrophysics of the APS and currently serves on the Scientific Editorial Board of the AAS Journals. On the faculty at Yale, since 2000, she serves currently as the Director of the Franke Program in Science and the Humanities and was the Chair of the Women Faculty Forum from 2011-2014.

***personal bio**

Born in Coimbatore, India she grew up in New Delhi to academic parents who encouraged her to pursue her interest in science and research from a young age. With undergraduate degrees from M.I.T., she received her PhD from the Institute of Astronomy at Cambridge, where she was the first woman in Astrophysics elected to the Fellowship at Trinity College. She is the current Chair of the Department of Astronomy and an external PI at Harvard's Black Hole Initiative. In addition to her research work, she is deeply invested in interdisciplinary scholarship and public dissemination of science. Priya is also the author of a critically acclaimed book Mapping the Heavens and is currently working on her second book. She has collaborated with the sculptor Antony Gormley and their work was featured in the Venice Biennale in 2019 and her work with artist Alyson Shotz was featured in Guggenheim Museum in Bilbao.

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