Astronomy and Astrophysics Division presents

Special Talk

Dec. 12 at 1:00 - 2:00pm in room PAB 3-703

Joel Primack (UCSC)

Why Galaxies Start Pickle-Shaped: An Historical Introduction to Dark Matter and Galaxy Formation

Abstract: According to modern cosmology, invisible dark matter and dark energy drive the evolution of the universe – and astrophysicists are still working out the implications. Newton's laws explained why planetary orbits are elliptical, but not why the planetary orbits in the solar system are nearly circular, in the same plane, and in the same direction as the sun rotates. Laplace explained this as a consequence of angular momentum conservation as the sun and planets formed in a cooling and contracting protoplanetary gas cloud. For similar reasons, many astronomers once thought that galaxies would start as disks. But Hubble Space Telescope images of forming galaxies instead show that most of them are prolate – that is, pickle-shaped. This turns out to be a consequence of most galaxies forming in prolate dark matter halos oriented along massive dark matter filaments. This seminar will include background on the 2019 Nobel Prize in Physics to Jim Peebles "for theoretical discoveries in physical cosmology" [1] and the 2020 Lilienfeld Prize of the American Physical Society to Joel Primack "for seminal contributions to our understanding of the formation of structure in the universe, and for communicating to the public the extraordinary progress in our understanding of cosmology" [2].

[1] https://www.nobelprize.org/prizes/physics/2019/prize-announcement/, https://www.nobelprize.org/uploads/2019/10/advanced-physicsprize2019.pdf.
[2] https://www.eurekalert.org/pub_releases/2019-08/aps-aa2082719.php, https://news.ucsc.edu/2019/09/primack-lilienfeld-prize.html. (See also Primack's popular article https://www.americanscientist.org/article/why-do-galaxies-start-out-as-cosmic-pickles.)