

CECI COLLOQUIUM

THE JAMES WEBB SPACE TELESCOPE AND THE DISTANCE NETWORK: NEW PATHS TO UNDERSTANDING THE HUBBLE TENSION



ADAM RIESS, NOBEL LAUREATE
JOHNS HOPKINS UNIVERSITY



One of the most basic questions in cosmology is: How fast is the Universe expanding today? Two powerful approaches give answers that should agree but do not. Measurements based on the cosmological model calibrated by the cosmic microwave background predict one value for the Hubble constant H_0 , while direct measurements using the cosmic distance ladder give a higher value. The difference, now exceeding 5σ , is known as the Hubble tension and has persisted for more than a decade and challenges Λ CDM.

The James Webb Space Telescope (JWST) provides a new way to test the local distance ladder that underlies the direct measurement of H_0 . By observing Cepheid variable stars and other distance indicators in galaxies that host Type Ia supernovae, and that were previously studied with the Hubble Space Telescope (HST), JWST allows a direct and independent check of those earlier measurements at higher resolution. These observations are also part of a broader effort to build a more robust local distance network, combining multiple independently calibrated distance indicators across the Milky Way and nearby galaxies. This network approach allows different rungs of the distance ladder to cross-check one another and helps expose potential systematic errors.

I will review several tests of possible systematics. The JWST observations closely match the HST results across multiple methods and wavelengths, ruling out several suspected sources of systematic error and strengthening the case that the Hubble tension is real. In addition, the distance network results show that the tension does not depend on any single source, team, or sample. Rather, it may signal that something important is missing from our current picture of the Universe.



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