Contribution ID: **9** Type: **not specified**

Rapid automated detection and modeling of strong lenses for time delay cosmography and supernova studies with LSST tansients

Monday, May 6, 2024 2:55 PM (20 minutes)

Thanks to the large sky coverage and the high cadence, the Rubin Observatory Legacy Survey of Space and Time (LSST) will reveal on the order of 100,000 strongly lensed galaxy-scale systems and revolutionize transient studies. With dedicated neural network classifiers trained on realistic mock images, we will be able to analyze all LSST images, and detect these lens candidates. By cross-matching them with all transients detected by LSST on a daily basis, we expect to detect a significant number of strongly lensed supernovae (slSNe). These very rare systems offer promising avenues in cosmology such as the direct measurement of the Hubble constant H0 completely independently from other probes. This allows us to assess the current tension on the H0 value, and the possible need for new physics. Furthermore, these slSNe help to constrain the supernova progenitor scenarios by facilitating follow-up observations of the counter images in the first hours after explosion. In my talk, I will present new achievements of the HOLISMOKES collaboration developing and testing required tools for this procedure. Specifically, I will highlight our various recent developments in lens classification, as well as the automation of strong-lens modeling with a residual neural network that brings the runtime from weeks down to fractions of a second, making the crucial follow-up scheduling immediately after the transient detection possible. The neural networks are trained on realistic images and tested on real systems from the Hyper Suprime Cam, which images are expected to match those from LSST very well. With these networks, retrained on LSST images as soon as these become available, we will be able to efficiently process the huge amount of images detected by LSST and plan the follow-up of promising transients in due time.

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Session Classification: Contributed