MACHINE LEARNING FOR ASTROPHYSICS
2ND EDITION CATANIA, 8-12 JULY, 2024

Contribution ID: **222** Type: **not specified**

LEMON: Lens modeling with Bayesian neural networks

Monday, 8 July 2024 12:30 (20 minutes)

Strong gravitational lensing is a powerful tool for constraining the total mass and mass density profiles of galaxies, by exploiting visible geometrical features such as lensed arcs, rings and multiple images around massive lens galaxies. Upcoming stage IV surveys, such as Euclid, are expected to discover between 10^4 and 10^5 new gravitational lenses over a total of 14,000 square degrees of the sky, far exceeding the current observed sample. However, traditional modeling of these lenses is often a slow and computationally expensive process. This hinders our ability to fully exploit these lenses for scientific purposes.
To address this challenge, we have developed LEns MOdeling with Neural networks (LEMON), a Bayesian Neural Network which can estimate parameters of galaxy-scale gravitational lenses, with associated uncertainties, in around 9 ms/lens. We trained LEMON on a large suite of simulated Euclid-like strong lenses, modeled as singular isothermal ellipsoids plus companions. We find that LEMON can recover all mass and light profile parameters of these lenses, with an accuracy comparable to traditional lens modeling techniques. we finally used LEMON to predict the parameters of "Euclidized"lenses, which have been modified to match the expected data quality of the Euclid survey, and real Euclid lenses. This allows us to check if LEMON can generalize its performance to real lenses, paving the way for the scientific exploitation of the upcoming strong lens discoveries.

Presenter: BUSILLO, Valerio

Session Classification: Past and future multiwavelength all-sky surveys