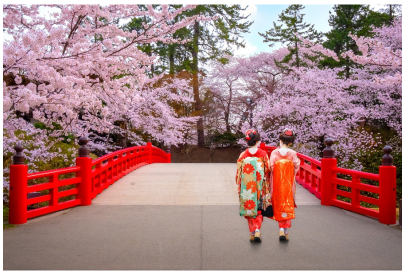

ID de Contribution: **89**

Type: **Non spécifié**

Development of an ultra-fast, likelihood-based, distance inference, for the next generation of type-Ia supernovae surveys

As of today, the Hubble diagram, which maps the luminosity distance-redshift relation for type-Ia supernovae (SNe Ia), allows us to infer cosmological parameters such as the Dark Energy equation of state (w) with an accuracy reaching a few per cent. Upcoming SNIa samples with O(30,000) SNe (30 times the current world-wide statistics), will allow us to reach the per cent level and start probing potential evolutions of w with the redshift. To reach this goal, an effort has to be made to push the level of the systematic uncertainties affecting the distance measurements down to ~0.1%. In particular, luminosity distances are affected by a selection bias called 'Malmquist bias'. Being able to see only the most luminous supernovae at high distances decreases the apparent mean magnitude of the population and therefore, negatively biases the estimation of distances at high redshifts.

In current analyses, the value of this bias is determined by time-consuming simulations based on either a Bayesian framework or a multiple-time fitting approach. As a faster alternative, we propose a maximum likelihood-based method relying on a fast computation of the truncated likelihood function and its first and second-order derivatives. This new method allows us for a given survey to simultaneously estimate the luminosity distances of supernovae and the selection function of the survey. This prevents the distances from being biased and eases the propagation of uncertainties as all the parameters of the model are fitted at the same time. Eventually, we expect the inference of luminosity distances to be faster by a few orders of magnitude when compared to a classic Bayesian framework. This is essential to be able to deal with the 30-fold increase of statistics expected within the next decade.

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Classification de Session: Poster session

Classification de thématique: No track