# GR 4: Cosmology I

Time: Tuesday 11:00–12:00 Location: KH 01.016

**Invited Talk** GR 4.1 Tue 11:00 KH 01.016

**From kinetic gases to an accelerated expanding universe - The Finsler Friedmann equation** — •Christian Pfeifer[1], Nicoleta Voicu[2], Annamaria Friedl-Szasz[2], and Elena Popovici-Popescu[2] — [1]ZARM, University of Bremen, Germany — [2]Faculty of Mathematics and Computer Science, Transilvania University, Brasov, Romania

The dynamics and the gravitational field of kinetic gases are usually described by the Einstein-Vlasov/Boltzmann equations. The evolution of the gas on phase space is encoded in the 1-particle distribution function (1PDF), while the Einstein equations determine the gravitational field of the kinetic gas from an energy momentum tensor that is obtained by averaging the 1PDF over all physical gas particle velocities (or momenta). Thus, the dynamics of the kinetic gas are described on phase space, but its gravitational field is derived on spacetime through an averaging procedure, which does not take all available information of the gas into account. The immediate questions is, how does the full 1PDF of a kinetic gas gravitate?

In this talk, I will discuss that Finsler gravity naturally elevates the geometry of spacetime to the same phase space footing as kinetic gas matter. It couples the full 1PDF to gravity without loosing information through averaging. In homogeneous and isotropic symmetry, the Finsler gravity equation takes a similar form as the Friedmann equations. Remarkably we find that this Finsler Friedmann equation possesses solutions describing an accelerated expanding universe without the need of a cosmological constant or any other additional quantities.

GR 4.2 Tue 11:30 KH 01.016

**The Hubble Tension: Overview, Recent Progress, and the Path Forward** — •Nils Schöneberg — Ludwig-Maximilians-Universität, München, Deutschland

Cosmological observations from the early universe and the late universe have been disagreeing about the value of the Hubble constant for more than one decade now. With the nominal significance of this Hubble tension reaching $5\sigma$, it has become one of the most pressing challenges in cosmology. Taken at face value it would signal a breakdown of the $\Lambda$ + Cold Dark Matter cosmological standard model. Prior to invoking new physics, it is paramount to re-investigate our astrophysical assumptions and to obtain independent confirmations. In this talk I present recent results in the search for the possible causes of the Hubble tension in early- and late-Universe data, including a joint effort from the $H_0$DN collaboration of constraining the Hubble constant using local astrophysical probes. I give a critical assessment of possible issues and solutions, and highlight future efforts that will be crucial in clarifying this challenge.

GR 4.3 Tue 11:45 KH 01.016

**Simulation-based inference with the integrated 3PCF** — •David Gebauer — Universität Bielefeld

We present a simulation-based inference (SBI) framework for analysing a higher-order weak lensing statistic, the integrated 3-point correlation function (i3PCF). Our approach forward-models the cosmic shear field using a suite of N-body simulations, including a comprehensive set of systematic effects such as intrinsic alignment, baryonic feedback, photometric redshift uncertainty, shear calibration bias, and shape noise. Using this, we have produced a set of DES Y3-like synthetic measurements for 2-point shear correlation functions and i3PCFs across 6 cosmological and 11 systematic parameters. Having validated these measurements against theoretical predictions and thoroughly examined for potential systematic biases, we have found that the impact of source galaxy clustering and reduced shear on the i3PCF is negligible for Stage-III surveys. Furthermore, we have tested the Gaussianity assumption for the likelihood of our data vector and found that the likelihood of the combined 2PCF + i3PCF data vector including filter sizes of 90' and larger can deviate from this assumption. Our SBI pipeline employs masked autoregressive flows to perform neural likelihood estimation and is validated to give statistically accurate posterior estimates. On mock data, we find that including the i3PCF yields a substantial 63.8% median improvement in the figure of merit. These findings are consistent with previous works on the i3PCF and demonstrate that our SBI framework can achieve the accuracy and realism needed to analyse the i3PCF in wide-area weak lensing surveys.