

Physics Seminar: Dam T. Son  
Wednesday, February 12 · 2:00 – 3:00pm

Location: 313

Title: Lorentz-covariant description of relativistic guiding-center motion

Abstract: When a charged particle moves through a magnetic field, it undergoes rapid cyclotron motion along with a slower movement of the guiding center. The guiding center primarily follows the magnetic field lines but gradually drifts away from them. Developing a manifestly Lorentz-covariant description of this motion has been a long-standing challenge in plasma physics and astrophysics. Although equations of motion formulated in the 1960s were implicitly Lorentz invariant, they were written in a cumbersome component form, which hindered any straightforward extension to general relativity until very recently. We present a relativistically invariant action for the guiding center that reproduces all known results. We further generalize this framework to curved spacetime, demonstrating that the so-called "curvature drift" and "gravitational drift" of the guiding center are connected by Einstein's principle of equivalence. This talk is based on [arXiv:2405.08073](https://arxiv.org/abs/2405.08073).