



# INVITATION

as part of the Gravitational Physics Literature Seminar

to the talk by

**Jakob MÖLLER**

(CMLS, École Polytechnique, Palaiseau)

on

***“The semiclassical limit of the Dirac equation”***

**Abstract:**

The Dirac equation was discovered by Paul Dirac in 1928 in order to find a first-order in time Lorentz-invariant Schrödinger equation for particles with half-integer spin. He discovered that the scalar wave function of the Schrödinger equation had to be replaced by a 4-component vector-valued wave function, which includes the two spin states of a charged fermion and predicted its antiparticle. The vector-valued nature implies that the Dirac operator is matrix-valued. In order to treat the semiclassical limit we transform the Dirac equation into the Wigner equation for the matrix-valued Wigner transform, which converges to the positive definite Wigner matrix measure. The latter obeys a matrix-valued Liouville equation where the oscillating part of the Wigner equation converges to a Lagrange multiplier that maintains the constraint that the Wigner matrix commutes with the Weyl symbol of the Dirac operator. The relativistic Vlasov equations for the electron and positron can then be recovered by projecting the Wigner matrix on the eigenspaces of the Dirac symbol and taking the trace over the spin components.

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**Time:** Wednesday, 4 March 2026, 2:15 p.m.

**Location:** Seminarraum A, Währinger Straße 17, 1090 Vienna, 2<sup>nd</sup> floor

sgd.: D. Fajman