

# ROTATING CLOUDS OF CHARGED PARTICLES IN GENERAL RELATIVITY

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Based on earlier work [2, 1] by H. Andréasson, M. Kunze and G. Rein for the uncharged case the existence of stationary solutions of the Einstein-Vlasov-Maxwell system is shown. These solutions describe rotating distributions of charged particles which are axially symmetric but not spherically symmetric.

The existence proof relies on the implicit function theorem and the desired solutions are constructed as perturbations around spherically symmetric solutions of the Vlasov-Poisson system. Due to these techniques of proof the solutions will not be very relativistic and rotate slowly. The particle charge parameter, however, does not need to be small. By constructing these rotating space-times with charged Vlasov matter, some properties of the electro-magnetic field become apparent. If the particle distribution has no overall angular momentum, an axially symmetric electric field and no magnetic field is obtained. If there is an overall angular momentum, there will be an electric field and a poloidal magnetic field. Toroidal magnetic fields cannot occur in the considered set-up. In the presentation, first a short introduction of the matter model is given. Then the technique of using the implicit function theorem to obtain axially symmetric, stationary solutions of the Einstein-Vlasov system is explained. Finally we demonstrate how charge can be included into the picture and how the additional difficulties can be dealt with.

## REFERENCES

- [1] H. ANDRÉASSON, M. KUNZE, G. REIN, *Rotating, stationary, axially symmetric spacetimes with collisionless matter*, Commun. Math. Phys. **329**, 787-808 (2014)
- [2] H. ANDRÉASSON, M. KUNZE, G. REIN, *Existence of axially symmetric static solutions of the Einstein-Vlasov system*, Commun. Math. Phys. **308**, 23-47 (2011)

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