THE CONFORMAL EINSTEIN FIELD EQUATIONS WITH MASSLESS VLASOV MATTER

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A stability result for de Sitter space and a semi-global stability result for Minkowski space as solution to the massless Einstein-Vlasov system is presented. These results are obtained by including the Vlasov matter model into a technique of treating the conformal Einstein field equations due to H. Friedrich.

Thereby the conformal Einstein field equations (CEF) on the Einstein cylinder are considered reducing the Cauchy problem for de Sitter-like and Minkowski-like space-times to a Cauchy problem on a finite time-range. Via a reduction procedure the CEF can be written as a collection of constraints and a symmetric hyperbolic evolutions system to which standard PDE-results (due to T. Kato [2]) apply. Global stability results for de Sitter space-time and semi-global stability results for Minkowski space-time can be obtained this way [1].

We briefly review this machinery. Thereafter we give a short introduction to the Vlasov matter model, a model widely used in astrophysics to describe galaxies, galaxy clusters, plasmas, or photon gases. It describes an ensemble of collisionless particles which interact via the gravitational field that they create collectively. Finally, we show how Vlasov matter can be included into the aforementioned framework, i.e. we study the CEF with massless Vlasov matter as two coupled, symmetric hyperbolic systems and discuss the existence and stability theory. By these means we obtain the aforementioned stability results. This is joint work with J. Joudioux and J. Valiente Kroon.

References

[1] H. Friedrich, *On the Existence of n-Geodesically Complete or Future Complete Solutions of Einstein's Field Equations with Smooth Asymptotic Structure*, Commun. Math. Phys. **107** (1986), 587-609.

[2] T. Kato, *The Cauchy problem for quasi-linear symmetric hyperbolic systems*, Arch. Rational Mech. Anal. **58.3** (1975), pp. 181–205.

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