Local existence of solutions to the Euler–Poisson system, including densities without compact support

Uwe Brauer
Universidad Complutense de Madrid, Plaza de Ciencias 2, 28040 Madrid, SPAIN
oub@mat.ucm.es

Local existence and uniqueness for a class of solutions for the Euler Poisson system is shown. These solutions have a density ρ which either falls off at infinity or has compact support. Since the Euler equations degenerate in such a setting, a regularisation has to be considered which complicates the proof considerably. The solutions have finite mass, finite energy functional and include the static spherical solutions for $\gamma = \frac{6}{5}$. The result is achieved by using weighted Sobolev spaces of fractional order and a new non linear estimate which allows to estimate the physical density by the regularised non linear matter variable. With these tools at hand we then prove the existence of solutions to the Euler–Poisson–Makino system by using a fixed-point argument. Gamblin also has studied this setting but using very different functional spaces. However, we believe that the functional setting we use is more appropriate to describe a physical isolated body and more suitable to study the Newtonian limit. The talk is based on a collaboration with L. Karp.