

Perturbations of the Kepler Problem under Dirichlet Boundary Conditions

Tingyu Zhong

School of Mathematical Science, Shanghai Jiao Tong University, China
TUNGYU-CHONG@SJTU.EDU.CN

Abstract

We study the forced Kepler problem in dimension two and three:

$$\ddot{u} = -\frac{u}{|u|^3} + \epsilon \nabla_u U(t, u), \quad u \in \mathbb{R}^d, \quad t \in [0, 1], \quad d = 2, 3, \quad (K_\epsilon)$$

combined with the Dirichlet boundary conditions

$$u(0) := \lim_{t \rightarrow 0^+} u(t) = 0 = \lim_{t \rightarrow 1^-} u(t) =: u(1), \quad (C)$$

where $\epsilon > 0$ is the perturbation parameter and $U : [0, 1] \times \mathbb{R}^d \rightarrow \mathbb{R}$ is a given C^1 function. Our solutions are allowed to collide with the singularity.

We combine the use of Levi-Civita regularization together with a perturbation result of critical manifolds to study multiplicity of solutions for problem $(K_\epsilon)-(C)$.

This is a joint work with professor Antonio J. Ureña at the Department of Applied Mathematics, University of Granada, Spain.