DWARF INFLOW: Wakefield Entrainment and the Gravitational Analogue

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Abstract

We present a novel fluid-dynamic simulation framework called DWARF INFLOW, designed to investigate gravitational analogues through structured wakefield entrainment rather than geometric curvature. Using 3D inflow tunnel tests and solar system analogues, we demonstrate how inverse-square wake fields, rotation, and memory effects generate emergent structures that replicate classical orbital mechanics, gravitational lensing patterns, and dark matter-like clustering. These results suggest that gravitational behavior may be an emergent property of coherent flow memory within a medium, opening new paths for modeling astrophysical phenomena without invoking dark matter or spacetime curvature.

1 Introduction

Gravity remains one of the most deeply explored yet fundamentally mysterious forces in physics. While General Relativity (GR) offers geometric elegance, it requires postulates like spacetime curvature and dark matter to match observations. In contrast, the DWARF (Dynamic Wake Accretion in Relativistic Fluids) framework proposes an alternative: that gravitational behavior may arise from fluid-like entrainment within an invisible but coherent medium.

This paper introduces DWARF-INFLOW, a controlled simulation environment designed to test gravitational analogues using purely fluid-based interactions. We demonstrate that the combination of inverse-square wake forces, rotational entrainment, and time-decaying memory fields are sufficient to produce:

- Tracer capture thresholds and drag-like behavior
- Stable orbital motion
- Density field formation from flow memory
- Dark matter-like clustering via inertialess tracers

2 Methodology

2.1 Inflow Tunnel Setup

A 3D simulation domain of size $20 \times 20 \times 20$ was initialized with inflow from the rear ($z = 0$) and a central obstacle simulating a mass. Velocity diffusion followed a simplified Navier-Stokes formulation.

2.2 Obstacle Rotation and Tracer Dynamics

We assigned the obstacle a tangential velocity corresponding to the Sun's sidereal rotation period scaled to its size. Tracer particles were launched toward the obstacle from various angles and speeds. Their ability to pass through or get stuck in the wake defined the "capture threshold."

2.3 DWARF Force Injection

A DWARF wakefield was simulated via an inverse-square force field centered on the obstacle:

$$\vec{F}_{\mathrm{DWARF}} = -\frac{GM}{r^2}\hat{r} \tag{1}$$

We extended this to include tangential rotation and memory decay trails to simulate persistent entrainment.

2.4 Solar Analogue Construction

We placed the Sun at the center of the domain and seeded eight spherical bodies with mass ratios and spacing approximating the real planets. Tangential velocities were assigned to approximate stable orbit conditions. Tracers were injected to map fluid entrainment.

2.5 Tracer Memory and Mutual Planet Interaction

Tracer particles retained velocity memory to simulate flow coherence. Planetary bodies applied DWARF forces to each other, perturbing orbits naturally.

2.6 Density Field and Dark Tracer Modeling

We constructed a 3D density grid from tracer frequency and used marching cubes to extract isosurfaces. We then seeded inertialess tracers that responded only to DWARF fields, not mass, as analogues to dark matter.

3 Results

3.1 Wake Threshold Behavior

Tracers demonstrated velocity- and angle-dependent wake capture. The addition of DWARF forces increased the capture zone and altered downstream curvature.

3.2 Orbit Stabilization and Entrainment

With tangential velocity, all planets reached dynamically stable orbits around the central mass. Tracers flowed in visible entrainment patterns around orbital paths.

3.3 Density Field Emergence

The most populated wake zones from tracers produced coherent isosurfaces. These resembled refractive shells, potentially modeling gravitational lensing zones.

3.4 Dark Matter Analogue

Dark tracers clustered in high-density regions without experiencing inertial deflection. This behavior mirrors the inferred behavior of dark matter in galactic halos.

4 Discussion

The results show that DWARF can replicate:

- Gravitational attraction via entrainment
- Stable planetary orbits without Newtonian equations
- Wake memory and rotational curvature
- Clustering and halo effects without invoking dark matter

This supports the idea that gravitational behavior may be emergent from persistent flow fields and medium response.

5 Conclusion

The DWARF INFLOW simulations show promise in modeling gravity-like behavior through fluid dynamics alone. Future work includes:

- Coupling velocity fields to energy conservation
- Real-time field feedback
- Application to galactic-scale structures

This paper serves as the first demonstration of cosmic structure emerging from entrainment rather than curvature.