Section 6: Phase Gravity

The Geometric Theory of Phase (GPT) offers a novel perspective on gravity, reinterpreting it not as a consequence of space-time curvature in the sense of General Relativity, but as an emergent phenomenon arising from the way massive objects (phase vortices) interact with and modify the phase background.

- **6.1 Mechanism:**
  - At its core, a massive object in GPT is a stable phase vortex, which represents a region of localized and modified phase tension (T_{vortex}) compared to the equilibrium tension of the background (T_0). This localized tension perturbs the surrounding phase background.
  - Other massive objects (other phase vortices) then move in response to the gradient of this altered phase tension, following paths that minimize the overall phase energy of the system. This movement is perceived as gravitational attraction.
  - This interaction can be described using a scalar phase gravitational potential, $\Phi_G(x,t)$, which represents the deviation from the background equilibrium tension. The source of this potential is the density of phase mass, $\rho_m(x,t)$, which reflects the distribution of stable phase vortices.
- **6.2 The Gravitational Constant (G_{phase}):**
  - In the static case and for a linear response of the background, the phase gravitational potential Φ_G is related to the phase mass density ρ_m by a Poisson-like equation: $\nabla^2\Phi_G = 4\pi G_{phase}\rho_m$.
  - G_{phase} is the phase gravitational coefficient. Unlike Newton's G, G_{phase} is not postulated as a fundamental constant but is considered a derivable parameter that characterizes the properties of the phase background itself—specifically, its "responsiveness" or "elasticity" to the presence of phase mass, or equivalently, its inverse phase viscosity (η_{phase}). The theory suggests $G_{phase} \sim 1/\eta_{phase}$. For practical purposes, in many initial calculations, G_{phase} can be taken as approximately equal to Newton's G.
- **6.3 Macroscopic Effects (Explaining "Dark Matter" Phenomena without Dark Matter):**
  - GPT proposes that on galactic scales, the simple $1/r^2$ behavior of gravity derived from the static potential is insufficient. The dynamic response of the phase background to the presence and motion of large masses becomes significant. This dynamic response encompasses effects like the background's viscosity and the influence of the critical tension threshold $T_{critical}$ for vortex stability.
  - This leads to an additional gravitational acceleration component that is not directly tied to the visible mass distribution in a simple Newtonian way. This effect is parametrized by a term κ, such that the total gravitational acceleration becomes approximately $g \approx \frac{G_{phase}M_{vis}}{r^2} + \frac{\kappa}{r}$. Alternatively, this can be seen as giving rise to a MOND-like characteristic acceleration scale a_0, where $\kappa \approx a_0 R_{gal}$ (with R_{gal} being a characteristic galactic radius).
  - The term κ (or a_0) is not a universal constant added ad-hoc but arises dynamically from the properties of the phase background. It is significant when the Newtonian gravity from visible mass M_{vis} is "insufficient" (e.g., on galactic outskirts) and small or negligible when M_{vis} is "sufficient" (e.g., within the solar system).
  - **Gravitomagnetism Hypothesis:** A key hypothesis within GPT is that this dynamic response of the background, responsible for the κ/a_0 effect, has a **gravitomagnetic** nature. It is proposed that the collective motion (e.g., rotation) of masses within a galaxy creates an effective "gravitomagnetic field" B_g in the phase background. This field then exerts an additional force on test masses, analogous to the Lorentz force in electromagnetism, contributing a term like $f(v, B_g(r))$ to the total acceleration. The source of this dominant B_g is likely the rotating central massive object of the galaxy (e.g., a supermassive black hole or dense bulge).
  - **Dynamic Nature of κ and Galactic Diversity:** The magnitude and even the sign of the κ effect (and thus the manifestation of "dark matter"-like effects) can be dynamic. If the orientation of the central B_g field changes relative to the galactic rotation, or if its strength varies (e.g., due to activity in the galactic nucleus), the gravitomagnetic contribution can change.
    - When the galactic rotation is well-aligned with a strong B_g, the κ effect is significant, leading to flat rotation curves.

  - If B_g is weak, misaligned, or has recently changed orientation, the gravitomagnetic contribution can diminish or become repulsive ("magnetic friction"), leading to dynamics primarily governed by visible mass ($\kappa_{fit} \rightarrow 0$). This transition phase might involve dissipation of phase energy into the galactic halo, potentially "heating" it and increasing its non-visible (e.g., IR) luminosity. This offers an explanation for the diversity of galactic rotation curves and the appearance of "baryonic" galaxies that seem to lack dark matter, without requiring different amounts of actual dark matter.
- **6.4 Gravitational Waves:** In GPT, gravitational waves are not ripples in the fabric of spacetime itself, but rather propagating disturbances or waves of phase tension (or phase potential Φ_G) through the phase background. These waves are generated by accelerating massive phase vortices (e.g., merging black holes or neutron stars) and propagate at the speed c, but their dynamics may include damping due to the phase viscosity of the background. The equation describing their propagation is an analogue of the wave equation with a damping term related to η_{phase}.