

Quantum Potential of Gravity As An Alternative to CDM Theory

Max I. Fomitchev · fomitchev@adelphia.net

Why Search for Alternatives to CDM?

- *NO CDM particles detected*
- *Simulation problems (Cusps, LSBs)*
- *MANY ad hoc assumptions*

New Alternative: Quantum Potential of Gravity

- + Bohm: *Potential = Classical + Quantum*
- + Only one assumption

Consequences:

- Quantum effects dominate in weak fields
- Gravity = Classical *PLUS* Quantum Force

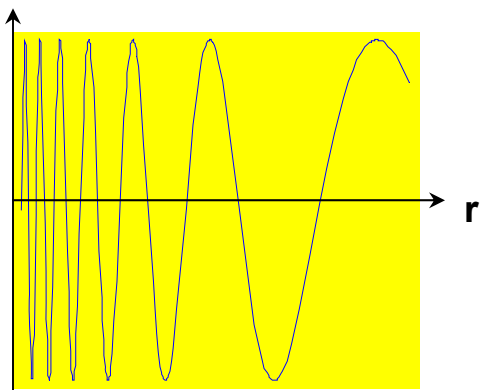
$$F_{\text{Gravity}} = GM/r^2 + F_{\text{Quantum}}$$

- F_{Quantum} acts *in addition* to Newtonian force
- New predictions for stellar systems

Point-Source Quantum Potential

- Unknown and must be postulated:
spreading harmonic wave

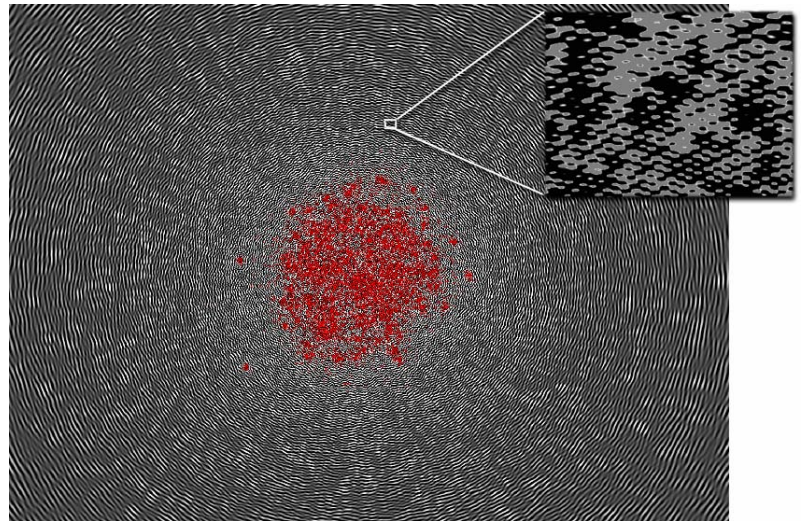
$$Q(r) = Q_0 \sin[ar/(r+c)]$$



- Schrödinger equation *does not* require $Q(r)$ to decay with distance!

Macroscopic Field:

- Localized fluctuations
- Circular grooves
- New dynamics!



New Dynamics = Quantum Scattering Force

- Scattering from fluctuations

$$F_{\text{Quantum}} = dp/dt \sigma = kGU^2 \rho_l / v^2$$

where σ - scattering probability,

U – fluctuation energy

ρ_l - linear density of fluctuations

Properties of Quantum Potential

- $U \sim M_{\text{Total}}^{0.5}$
- $\rho_I = f[\rho_{\text{Matter}}(\mathbf{r})] \approx \begin{cases} \text{const, when } \rho_{\text{Matter}}(\mathbf{r}) \sim \text{const,} \\ \sim 1/r, \text{ when } \rho_{\text{Matter}}(\mathbf{r}) \rightarrow 0. \end{cases}$

Implications for Stellar Dynamics

- Circular Rotation Velocity

$$a = v^2/r = GM(r)/r^2 + k_1 GM_{\text{Total}} \rho_I / v^2$$

- In Galactic Bulge ($\rho_{\text{Matter}} \sim \text{const}$)

$$v \sim (GM_{\text{Total}} r)^{0.25} \quad \text{Rising Curve}$$

- In Galactic Disk ($\rho_{\text{Matter}} \rightarrow 0$)

$$v \sim (GM_{\text{Total}})^{0.25} \quad \text{Flat Curve \& Tully-Fisher Law!}$$

- **MOND-Like Behavior When $\rho_{\text{Matter}} \rightarrow 0$**

$$a = v^2/r = GM(r)/r^2 + GM_{\text{Total}}/r^2 k_1 \rho_I \Rightarrow a/a_0$$

↓

$$a \approx (GM/r^2 k_1 \rho_I)^{0.5} = (ga_0)^{0.5}; \quad a_0 = k_1 \rho_I$$

- **Newtonian Behavior When the Field is Strong (Internal or External)**

Implications for Stellar Systems

Theoretical M/L Ratio:

$$\frac{M}{L} \propto \frac{r}{\sqrt{L}} \quad (*)$$

Spiral Galaxies:

- Flat Rotational Curves for HSBs
- Rising Rotational Curves for LSBs
- Tully-Fisher Law Holds Exactly

Elliptic Galaxies:

- Large M/L for Giant Ellipticals
- Small M/L for Ordinary Ellipticals
- Scaling Relations Follow From (*)
- Fundamental Plane Follows From (*)

Dwarf Spheroid Galaxies:

- Large M/L

X-Ray Galaxy Clusters:

- Flat X-Ray Temperature Profiles
- Scaling Relations and Follow From (*)

Possible Connection to Inflation?

- Quantum Potential in Expanding Universe Will Produce Universal Drag Force Accelerating Expansion