If Modified Newtonian Dynamics [MOND] is Correct, Then even ‘Dark-Energy’ may not be needed

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Abstract and Introduction:

As an attempt to explain the anomalous constant velocity of the stars at the out-skirts of galaxies, known as ‘flattening of galaxies rotation-curves’, Milgrom M. has proposed a modification to Newtonian Dynamics; that at very low gravitational accelerations, of the order of 10^{-10} meter/second^2, and below, the gravitational acceleration experienced by the stars at the out-skirts of spiral galaxies may be: $[(G M / R^2)(a_0)]^{1/2}$, instead of Newtonian expression: $[G M / R^2]$. It has been found by this author, as well as by others, that a_0 is close to $H_0\, c$ (where H_0 is Hubble’s constant, and c the speed of light). Also, a_0 is close to $G M_0 / R_0^2$ (where M_0 is total mass of the universe required for closer of the universe, and R_0 is radius of the universe, $R_0 = c / H_0$). Based on these findings, it is indicated here that the strength of gravity beyond the boundary of spiral galaxies may be much higher, than expected from Newtonian gravity. Therefore, the actual attractive force between the galaxies can be much higher than that due to Newtonian Dynamics; and the total mass of the universe required for closer of the universe, may be as less as it is already observed. Thus, if MOND is correct, then even ‘dark-energy’ may not be required.

The Derivation:

The actual acceleration experienced by the stars at the out-skirts of spiral galaxies:

Actual acceleration $a_{\text{Actual}} = \text{Velocity } v_{\text{observed}}^{\ 2} / R = [(G M / R^2)(G M_0 / R_0^2)]^{1/2}$

i.e. $a_{\text{Actual}} = \text{Velocity } v_{\text{observed}}^{\ 2} / R = [(G M / R^2)(M_0 / M)^{1/2}(R / R_0)]$

Since the total-mass of the universe M_0 is much higher than mass of a single galaxy M, and at the inter-galactic distances R becomes comparable with R_0, the actual acceleration experienced by the galaxies can be much higher, and sufficient for closer of the universe. And no ‘dark-energy’ may be needed.

Conclusion:

Though the observable mass of the universe is hardly 5% of the total-mass currently thought to be required for closer of the universe, if MOND is correct then gravitational attraction between the galaxies can be much stronger than that expected of Newtonian gravity. In that case, just the observable mass of the universe may be sufficient for closer of the universe; and no ‘dark-energy’ may be needed.