Hubble law in a repulsive matter–antimatter galaxies simulation

Dimopoulos C[1], Stamokostas G L[2], Gkouvelis L[3] and Trigger S A[4,@]

[1] Chatzivei Education, Athens, Greece
[2] University of West Attica, Alexandras Avenue 196, Athens 11521, Greece
[3] Ames Research Center of the National Aeronautics and Space Administration, Moffett Field, California 94035, United States
[4] Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow 125412, Russia

[@] satron@mail.ru

Consideration of dark energy is intended to explain the unexpected but observed acceleration of the universe. Baryon asymmetry in initial matter–antimatter annihilation is mostly accepted to explain the absence of observations of annihilation radiation. It is mostly accepted fact that we live in a matter dominated universe. These are two of the greatest puzzles of modern cosmology as they are not compatible with well-known and accepted physics. Here we will assume that antimatter gravitationally repels matter [1,2], knowing that it does not contradict the available experimental data. In the considered concept the mechanism of universe expansion, based on equal quantities of repulsive matter and antimatter, seems clear and baryon asymmetry is absent. We have performed simulations using initial objects with properties of small galaxies with encouraging results. Here we show that the extracted data clearly create the Hubble effect regardless of the initial distribution of galaxy mass, velocities, mergers (annihilations) and other initial conditions. In addition, we provide explanations for the basic problems of modern cosmology mentioned above. These results allow us to consider the existing hypothesis of gravitational repulsion of matter and antimatter as realistic. The decisive word remains undoubtedly with the planned experiments with antiparticle beams at CERN.

[1] Chardin G and Manfredi G 2018 *Hyperfine Interact.* **239** 45
[2] Ignatov A M and Trigger S A 2016 *Bull. Lebedev Phys. Inst.* **43** 232