Relative Movement of Two Bodies − Hubble's Law, Expanding Universe and Newton's Laws Controversies

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Based on the comprehensions of Roger Boscovich (1711-1787) /1, 2/ we develop the mathematical expressions for the relative movement of two bodies in parallel trajectory as per equation (1) and crosswise trajectory as per equations (2a, 2b) starting from the idea that there is no force interacting between the bodies.

$$V_r = \mathrm{d}r/\mathrm{d}t = (v_1\text{-}v_2)^2 t/[D^2+(v_1\text{-}v_2)^2 t^2]^{1/2} \quad \textbf{(}\text{parallel trajectories}) \tag{1}$$

Here V_r is relative velocity and r is distance between two bodies having velocities v_1 and v_2; t is time and D is distance between parallel trajectories.

$$r = [(a+v_1t)^2 + (b+v_2t)^2 - 2(a+v_1t)\,(b+v_2t)\cos\alpha]^{1/2} \quad \text{(crosswise trajectories)} \tag{2a}$$

$$V_r = \mathrm{d}r/\mathrm{d}t = [(v_1^2+v_2^2 - 2v_1v_2\cos\alpha)t + a(v_1 - v_2\cos\alpha) + b(v_2 - v_1\cos\alpha)]/r \text{ (crosswise)} \tag{2b}$$

In (2a and 2b) all symbols are the same as in (1), but a and b are the initial distances (at t=0) of bodies from the crossing of trajectories making the angle α.

Surprisingly, even in the absence of initially considering a force interacting between the bodies, there arises some acceleration (or deceleration) of relative movement depending on time and the distance between bodies. Hence, this raises some controversies concerning the validity of Hubble's law, expanding Universe concept and Newton's laws that are then discussed.

References

/1/ Boscović R., "Philosophiae naturalis theoria redacta ad unicam legem virium in natura existentium", Wien (1758, first edition), Venice (1763, second edition); "A Theory of natural philosophy", The Massachusetts Institute of Technology, M.I.T. Press, Cambridge (1922) and(1966); "Teorija prirodne filozofije svedena na jedan jedini zakon sila koje postoje u prirodi", (bilingual: Latinski i Croatian), Liber, Zagreb (1974).

/2/ "Philosophiae recentioris a Benedicto Stay versibus traditae libri X cum adnotationibus, et supplementis P. Rogerii Josephi Boscovich", I-III, Typis et sumptibus Nicolai, et Marci Palearini, Rim (I, 1755; II, 1760; III, 1792)