Hermann Minkowski's Spacetime and the "Dark Matter" Problem

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Hermann Minkowski's spacetime entails a Lorentz Symmetry group. Thus, any physical theory applicable to an arbitrary inertial observer in this spacetime must be symmetrical under the Lorentz group. Such equations do not allow "action at a distance" solutions of the Newtonian gravity type, but rather require retarded solutions.

Galaxies are huge physical systems having dimensions of many tens of thousands of light years. Thus, any change at the galactic center will be noticed at the rim only tens of thousands of years later. Those retardation effects seem to be neglected in present day galactic modeling used to calculate rotational velocities of matter in the rims of the galaxy. The significant differences between the predictions of Newtonian theory and observed velocities are usually explained by either assuming dark matter or by modifying the laws of gravity (MOND). In this presentation, we will show that taking retardation effects into account one can explain the azimuthal velocities of galactic matter and the well-known Tully–Fisher relations of galaxies. Moreover, gravitational lensing phenomena which is attributed to "dark matter" can also be explained by retardation. It is shown that due to retardation "dark matter" mass must be the same for both lensing and galactic rotation curves. Finally, we demonstrate that in Hermann Minkowski's spacetime the virial theorem must be corrected and thus the "dark matter" of galaxy clusters can be interpreted in terms of retardation.

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