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MIMS現象数理カフェセミナー

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Physical Interpretation of Galactic Dark-Matter-Effect: Combined Action of Gravity and Fluid-Lorentz-Force

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Abstract：Physical and dynamical mechanisms are studied for rotating galaxies surrounded with abundant gas clouds, based on the general relativity theory. This is a novel approach to the galactic dark-matter-effect observed in spiral galaxies. Physical unfolding within galaxies has been investigated as a dynamical effect caused by a combined action of the gravity and a new physical effect. The latter is created by high-speed motion of gas clouds observed in galactic space. The theoretical formulation is based on fluid mechanics extended to relativistic theory. The dynamical mechanism proposed by the present formulation shows an excellent match with the observed finding by McGaugh, Lelli & Schombert (2016).

This matching implies that the present approach has captured an essential aspect of the galactic dark-matter effect. In the galactic space, the strength of gravity force becomes weaker as the distance R from the galactic center increases, while the new physical effect acting inward (called *fluid-Lorentz-force)* grows towards the halo as R increases. The two forces switch their roles effectively to keep the orbital velocity $\boldsymbol{v}$ nearly constant in the outer space of galaxies. Magnitude $|\boldsymbol{v}|$ of the velocity attains very high speeds of 40 ~ 200 km/sec, which are observed in most galactic halos. Existence of the fluid-Lorentz-force is not contradicting with the concept of the theory of general relativity. This talk reports the results of the collaborative study with Masanori Hashiguchi (MIMS, Visiting Scientist).

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