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Integral Gauss's Law of Gravity with Gravitational Field Flux Lines to Interpret Rotation Curves and Tully-Fisher Relation of Disk Galaxies TE-CHUN WANG, Li-Chih High School — Objects in disk galaxies can show Non-Keplerian rotational behaviors below a critical acceleration of the order of 10ˆ-10 m/sˆ2. MOND (Modified Newtonian Dynamics) theory provided good fits for the rotation curves and the Tully-Fisher relation by postulating that either the Newton's force law or equivalently the Newtonian gravity can be modified. In this report, a physical mechanism of 1/r distance dependent field at non-relativistic limit is proposed within a gravitational field flux conservation picture by generalizing the Integral Gauss's law of gravity. Firstly, 1/r dependence together with a disk thickness dependence of gravitational field and in turn the flat rotation curves are obtained by a Gaussian surface with cylindrical symmetry where most of the gravitational fluxes are distributed eventually along the radial direction of the disk plane. The Gaussian disk thickness as a hidden dynamical variable is discussed with observational evidences. Subsequently, a spherical to cylindrical transition, across a certain critical field, of the Gaussian surface symmetry is shown to give the exact algebraic M$\propto$vˆ4 Tully-Fisher relation. The structural-dynamical relations revealed by the radial acceleration relation from SPARC (Spitzer Photometry and Accurate Rotation Curves) data of Stacy McGaugh's team are mapped to the field flux distribution picture. The bulge to disk structural transition can be directly interpreted by the Newtonian to Non-Newtonian gravitational flux distribution. Extensions of this gravitational lines of force picture to larger scale structures are discussed.

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