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An Analytic Mathematical Model to Explain the Spiral Structure and Rotation Curve of NGC 3198.

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An analytical model of galactic morphology is presented. This model presents resolutions to two inter-related parameters of spiral galaxies: one being the flat velocity rotation profile and the other being the spiral morphology of such galaxies. This model is a mathematical transformation dictated by the general theory of relativity applied to rotating polar coordinate systems that conserve the metric. The model shows that the flat velocity rotation profile and spiral shape of certain galaxies are both products of the general theory. Validation of the model is presented by application to 878 rotation curves provided by Salucci, and by comparing the results of a derived distance modulus to those using Cepheid variables, water masers and Tully-Fisher calculations. The model suggests means of determining galactic linear density, mass and angular momentum. We also show that the morphology of NGC 3198 is congruent to the geodesic of a rotating reference frame and is therefore gravitationally viscous and self bound.

Author: ROUT, Bruce (Astronomical Teacher Training Institute)

Presenter: ROUT, Bruce (Astronomical Teacher Training Institute)

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