Unified Understanding of Relativity and Quantum Mechanics through the Repulsion Graviton Space Model

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Personal Publication

October 30, 2024

This paper is the English translation of the original Japanese version.

Abstract

In this study, we propose the “Repulsion Graviton Space Model (Re:GraviS Model),” which elucidates the role of gravitons in the formation of cosmic structures and provides a framework for explaining gravity, dark matter, and dark energy. To support the validity of this model, we analyze the consistency between observational data and the “Galactic Rotation Curve Graviton-Modified Inverse Square Decay Model (Galactic Rotation Curve MiSAKi Model).” The MiSAKi Model incorporates the effects of gravitons into the circular orbital velocity equation derived from the spherically symmetric solution of Einstein’s field equations, namely the Schwarzschild solution. The insights obtained from this validation realize a unified understanding of relativity and quantum mechanics.

Keywords: Quantum Gravity Theory, Graviton, Dark Matter, Dark Energy, Black Hole, Galactic Rotation Curve

Introduction

The discrepancy between observed and theoretical rotational velocities at the outer edges of galaxies has long been a major challenge in physics. This study proposes a novel hypothesis: gravitons exert a repulsive force against space, and gravity can be explained as “the entropic-driven reaction of space countering this repulsion.” Using the circular orbital velocity equation derived from the spherically symmetric solution to Einstein’s field equations (the Schwarzschild solution) and incorporating the effects of gravitons, we analyze galactic rotation curves through a fitting model, the Galactic Rotation Curve MiSAKi Model. Based on the results, this study explores the potential for addressing the longstanding challenge of unifying general relativity and quantum mechanics while providing new insights into the nature of the cosmos.

Model Overview and Theoretical Background

The “Galactic Rotation Curve Graviton-Modified Inverse Square Decay Model (Galactic Rotation Curve MiSAKi Model)” employed in this study was derived by incorporating the effect of gravitons into the circular orbital velocity equation obtained from the Schwarzschild solution, a spherically symmetric solution to Einstein’s field equations. This model is based on the hypothesis that gravitons exert “spherically symmetric repulsive forces” against space, gradually decaying without interacting with matter, with their strength depending on the concentration of gravitons. Furthermore, the model assumes that gravitons act as dark matter on smaller scales, while on larger cosmic scales, they expand space and function as dark energy. By aligning the graviton concentration with the role of dark matter, this model resolves the longstanding mystery of “galactic rotation curves,” a significant challenge in physics.

Methodology

Using a high-precision fitting verification script developed with AI tools (ChatGPT4.0), we analyzed the alignment between the Galactic Rotation Curve MiSAKi Model and the SPARC dataset of observed galactic rotation curves (175 galaxies). This analysis, performed using nonlinear least squares fitting, involved visualizing results through plots, evaluating adjusted determination coefficients, and examining residuals. To account for the influence of anti-gravitons, imaginary components arising when α takes negative values were appropriately handled using numpy functions, enabling a comprehensive evaluation of the combined effects of gravitons and anti-gravitons. Furthermore, after completing all fittings, we conducted a comprehensive correlation analysis of key parameters, including the graviton concentration (parameter α), the graviton effect range (scale parameter R), and other physical parameters such as observed velocity components, disk components, and bulge components. To mitigate the risk of overfitting, parameter ranges during fitting were constrained to appropriate limits ($-150{,}000 < \alpha < 150{,}000$ and $0.1 < R < 200$).

Results and Discussion

The analysis confirmed a high degree of fit between the Galactic Rotation Curve MiSAKi Model and most galaxies, with a mean adjusted determination coefficient (adjusted R^2) of 0.802, a median of 0.964, and a standard deviation of 0.332. Across the 175 analyzed cases, the high median adjusted R^2 value of 0.964 and the small standard deviation of 0.332 demonstrate the model's accuracy. Residual distributions were random and confined to a narrow range (mean residual 0.110, standard deviation 5.58), with no signs of overfitting. This confirms that the model reproduces galactic rotation curves with high precision and reliability without excessive adaptation to observed data. Correlation analysis further revealed a very strong positive correlation between the graviton concentration parameter (α) and both the observed velocity and the disk velocity components (average observed velocity, Avg Vobs(r): 0.956; average disk velocity, Avg Vdisk(r): 0.863). This suggests that graviton concentration significantly influences galactic rotational velocities and aligns faithfully with the role of dark matter inferred from Einstein's equations. Additionally, the distributions of α and the scale parameter R were found to be concentrated within specific ranges. The clustering of α suggests a certain threshold or standard for graviton concentration on galactic scales. Furthermore, the scale parameter R, which represents the range of graviton effects, showed no dependency on α or other physical parameters and consistently converged within a specific range. This indicates that graviton effects operate at a fixed scale independent of their concentration or the material density of individual galaxies. These findings clarify that gravitons exhibit no material interactions but instead gradually decay while exerting spherically symmetric repulsive forces against space, contributing to the maintenance of rotational velocities at the outer edges of galaxies through interactions with space. Furthermore, the absence of material interactions implies that gravitons do not interfere with the Higgs field or interact with Higgs particles responsible for imparting mass. This supports the unique characteristics required by conventional quantum mechanics, where gravitons are massless, closed strings capable of interdimensional movement. In this analysis, α did not take zero or negative values, and thus no direct effects of anti-gravitons were observed. However, this result does not directly negate the existence of anti-gravitons because α represents graviton concentration rather than the absolute number of gravitons. Based on these results, this study concludes that the mysterious force maintaining outer galactic rotational

velocities is “the graviton’s repulsive force against space.” The model’s fit with observational data and its non-interactive properties suggest that gravity, considered the weakest of the four fundamental forces, originates from “the entropic-driven reaction of space countering the graviton’s repulsive force,” establishing a causal relationship between graviton effects and spatial curvature. Moreover, the findings strongly suggest that the nature of dark matter is “the gravitons themselves,” while the nature of dark energy is “the graviton’s repulsive force against space.” This implies that the mysterious energy accelerating the universe’s expansion at superluminal speeds is highly likely to be “the graviton’s repulsive force against space.” The mechanism by which massless gravitons concentrate may involve their indirect gravitational effects, namely, entropy-driven spatial repulsion confining gravitons within space and causing them to converge at a single point. This process represents a form of self-causality, potentially consistent within black hole event horizons and spacetime singularities, where traditional physical laws are believed to break down. This study suggests that black holes begin to form when spatial repulsion momentarily surpasses the graviton’s repulsive force against space. Spacetime singularities may not form as mere zero-dimensional points but rather as complex spatial regions that compress inward while exhibiting quantum-like spatial spread. When spatial repulsion strength approaches that of graviton repulsion, the resulting spacetime singularity can be interpreted as a spacetime region where graviton repulsion and spatial repulsion are in perfect equilibrium. This framework allows for quantum effects within spacetime singularities, avoiding the infinities that have long posed challenges in traditional quantum mechanics. However, assuming perfect equilibrium between graviton repulsion and spatial repulsion might prevent quantum spread within the singularity. To reconcile this within quantum mechanics, it may be necessary to consider that gravitons transition from “open string” to “closed string” states under extreme conditions in spacetime singularities, allowing them to transform into energy and escape to other dimensions. In this interpretation, gravitons function as particles transmitting and preserving information across dimensions, ensuring that information is not lost beyond event horizons. This complements and potentially extends recent soft hair theory, providing a new perspective on resolving the black hole information paradox. Spacetime singularities may thus act as interdimensional gateways for gravitons, reconciling the information paradox while permitting quantum spread within singularities. Furthermore, this mechanism for black hole formation not only explains the phenomenon of time dilation in moderately strong gravitational fields but also

predicts changes in time within black holes themselves. In moderately strong gravitational fields, including those near black holes, graviton repulsion expands space, lengthening the Planck scale and increasing the minimum unit of quantum motion. This slows physical processes on the quantum level, effectively lengthening time. This matches relativity's prediction that objects near event horizons experience "time dilation" and appear to freeze from an external observer's perspective. Reversing this phenomenon to view it from an opposite perspective, the spacetime region near the event horizon where the object is located is characterized by extremely strong graviton repulsion, which significantly expands space. This causes physical motion at the quantum level to slow down, elongating the object's time. As a result, it can be explained that the observer's time appears relatively shorter in comparison. This consistency with relativity and actual phenomena further supports the theoretical model. However, within black holes, this relationship may invert. As spatial compression continues spontaneously, the Planck scale shortens, reducing the minimum unit of quantum motion. Consequently, physical processes accelerate on the quantum level, shortening time in the black hole's spacetime. From the perspective of an observer within the black hole, external objects may appear frozen, providing new insights into time changes in black holes. These findings suggest that observers' perception of constant time may be a cognitive illusion arising from synchronization with quantum movement speed and Planck scale within their respective spacetime regions. Such spacetime phenomena might require an extended graviton spacetime repulsive model, termed the Repulsion Graviton Space-Time Model (Re:GraviST Model), as an evolution of the Repulsion Graviton Space Model (Re:GraviS Model).

Conclusion

In this study, the "Galactic Rotation Curve Graviton-Modified Inverse Square Decay Model (Galactic Rotation Curve MiSAKi Model)" was applied to analyze its alignment with the SPARC dataset of observed galactic rotation curves (175 galaxies). The results confirmed that the model demonstrates a high degree of consistency with observed galactic data, supporting the hypothesis that gravitons exert spherically symmetric repulsive forces against space. Furthermore, it was observed that the role of the parameter α, which represents graviton concentration, aligns

with the role of dark matter within galaxies, while the scale parameter R converges within a specific range. These findings led to the following key conclusions and possibilities:

1. Gravitons exert spherically symmetric repulsive forces against space.
2. The essence of gravity lies in the entropy-driven repulsion of space in response to the repulsive force of gravitons on space. Furthermore, the reason why gravity is considered the weakest of the four fundamental forces is that it operates through an indirect mechanism mediated by space.
3. Dark matter is composed of gravitons, while dark energy is the repulsive force of gravitons against space.
4. The causal relationship between gravitons and space explains the mechanism of black hole formation and the quantum spread within spacetime singularities, enabling an understanding of singularities within the framework of quantum mechanics and offering a new perspective for resolving the information paradox.
5. The time dilation dependent on the strength of the gravitational field can be explained within the framework of quantum mechanics, and it is also suggested that time may be shortened inside the event horizon.
6. The application of the Repulsion Graviton Space Model (Re:GraviS Model) and its theoretical extension to the Repulsion Graviton Space-Time Model (Re:GraviST Model) suggests the possibility of unifying general relativity and quantum mechanics, which has long been considered challenging.

These insights obtained through this study provide a new understanding of the unresolved fundamental problems in physics, including gravity, dark matter, and dark energy. Moreover, the following issues are highlighted as future research directions based on the results of this analysis:

1. Additional Validation of the Theoretical Model

There is a need to further evaluate the validity of the theoretical model by verifying its consistency with observational data beyond galactic rotation curves, such as gravitational waves and cosmic microwave background radiation.

2. Further Research on Black Hole Formation Mechanisms

It is necessary to apply the relationship between gravitons and space to the process of black hole formation and to verify it in detail through observational data and simulations.

3. Further Research on Black Hole Spacetime Singularities

Detailed simulations are required to investigate the behavior of gravitons and space within spacetime singularities.

4. Interpretation of Proper Time

It is necessary to consider and examine the physical basis of the hypothesis that the “illusion of constant time” arises from the natural synchronization of awareness and bodily reaction speeds with the Planck scale and quantum scale movement speeds of each spacetime region.

Through these future validations, the Repulsion Graviton Space-Time Model (Re:GraviST Model) is strongly expected to be established as an essential foundation for the completion of a “quantum gravity theory.”

References:This research is based on high originality and general knowledge, hence no specific references are cited.

Data Used:SPARC Galaxy Rotation Curve Dataset (175 galaxies)

https://astronomy.case.edu/2016/08/26/sparc-galaxy-database

Galactic Rotation Curve Graviton-Modified Inverse Square Decay Model

(Galactic Rotation Curve MiSAKi Model)

$$v_{\text{total}}(r) = \sqrt{\alpha \left(1 - \frac{1}{1 + \left(\frac{r}{R}\right)^2}\right)}$$

- $v_{\text{total}}(r)$: The total rotational velocity of the galaxy at a distance r from the center.
- α: A variable parameter representing the concentration of gravitons.
- R: A variable parameter representing the range of influence of gravitons.
- r: The radius (distance from the center).

Derivation Process

1. Einstein's Equation

Einstein's equation is the fundamental equation in the theory of relativity, describing the relationship between matter distribution and the curvature of spacetime.

$$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = \frac{8\pi G}{c^4} T_{\mu\nu} \tag{1}$$

2. Adoption of the Schwarzschild Solution

Assuming that "gravitons exert a spherically symmetric repulsion on space," we adopt the Schwarzschild solution, which is a spherically symmetric solution to Einstein's equation.

$$ds^2 = -\left(1 - \frac{2GM}{r}\right) c^2 dt^2 + \left(1 - \frac{2GM}{r}\right)^{-1} dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta \, d\phi^2 \tag{2}$$

3. Derivation of Circular Orbital Velocity Equation

From the Schwarzschild solution, the velocity equation for circular orbits is derived as follows :

$$v_{\text{orbit}} = \sqrt{\frac{GM}{r}} \tag{3}$$

4. Substitution Based on the New Hypothesis

In the above equation, $\frac{GM}{r}$ represents the gravitational attraction exerted by the central body on an object at distance r. Here, we introduce the hypothesis that "Gravitons exert a repulsive force on a spherically symmetric space that decays gradually without interacting with matter, and the strength of this force depends on the concentration of gravitons." To reflect this, we designed a modified inverse-square decay function, using the scale parameter R to represent the range of the graviton's influence, so that the graviton's repulsive force acts strongly at short distances and gradually maintains its influence at long distances. We replace $\frac{GM}{r}$ with the following function, expressed as the product of the graviton concentration α and the modified inverse-square decay function $1 - \frac{1}{1+\left(\frac{r}{R}\right)^2}$:

$$\frac{GM}{r} \to \alpha \left(1 - \frac{1}{1 + \left(\frac{r}{R}\right)^2}\right) \tag{4}$$

This equation represents the spherically symmetric repulsion of gravitons on space, decaying according to the inverse-square law as distance r increases. This allows us to incorporate the hypothesis into the formula while retaining the structural meaning of the original circular orbital velocity equation.

5. Final Derived Equation

As a result of applying the above substitution, the final circular orbital velocity equation that reproduces the galactic rotation curve is derived as follows :

$$v_{\text{total}}(r) = \sqrt{\alpha \left(1 - \frac{1}{1 + \left(\frac{r}{R}\right)^2}\right)} \tag{5}$$

- $v_{\text{total}}(r)$ is the total rotational velocity of the galaxy at distance r from the center
- α is the variable parameter representing the concentration of gravitons
- R is the variable parameter representing the range of influence of gravitons
- r is the radius (distance from the center)

To account for the influence of anti-gravitons, we do not ignore the imaginary component that appears when α is negative, and instead handle it appropriately using numpy functions.

重力子空間斥力モデルによる

相対性理論と量子力学の統合的理解

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個人著書

2024年10月30日

要旨

本研究では、アインシュタイン方程式の球対称解であるシュワルツシルト解から得られる円軌道速度式に重力子の効果を取り入れた、「銀河回転曲線重力子修正逆二乗減衰モデル（銀河回転曲線MiSAKiモデル）」と実際の観測データの一致から、宇宙の構造形成における重力子の役割と、重力、ダークマター、ダークエネルギーの正体を統一的に説明する「重力子空間斥力モデル（Re:GraviSモデル）」を提案し、相対性理論と量子力学の統合的理解を実現します。

Keywords: 量子重力理論、重力子、ダークマター、ダークエネルギー、ブラックホール、銀河回転曲線

導入

銀河の回転曲線における銀河外縁部の回転速度の観測値と理論値のずれは、物理学における長年の課題とされてきました。本研究は、重力子が空間に対する斥力を持ち、重力の正体が、「その斥力に対するエントロピー駆動の空間の反発」によって説明されるとする新たな仮説を提案し、アインシュタイン方程式の球対称解（シュワルツシルト解）から得られる円軌道速度式に重力子の効果を取り入れたフィッティングモデル（銀河回転曲線MiSAKiモデル）を用いて銀河の回転曲線の解析を行います。その結果をもとに、重力の理論的な扱い方の違いから困難とされてきた、「相対性理論と量子力学の統一」に向けた可能性と宇宙の真相を探究します。

モデルの概要と理論的背景

今回使用する「銀河回転曲線重力子修正逆二乗減衰モデル（銀河回転曲線MiSAKiモデル）」は、アインシュタイン方程式の球対称解であるシュワルツシルト解から得られる円軌道速度式の成分に、重力子の効果を取り入れた式を代入することで導かれたものであり、「重力子は、物質と相互作用することなく緩やかに減衰する球対称の空間への斥力を持ち、その強さは重力子の集中度に依存する」という仮説を反映しています。さらに、このモデルは、より小さなスケールでは重力子がダークマターとしての役割を果たし、宇宙広域のような広いスケールでは空間を押し広げることでダークエネルギーとしての効果を発揮することを仮定しており、重力子の集中度がダークマターの役割と一致することで、物理学の長年の課題であった「銀河の回転曲線の謎」が解明されます。

解析手法

AIツール（ChatGPT4o）を用いて開発した高精度フィッティング検証用スクリプト（非線形最小二乗法を採用）を使用し、SPARC銀河回転曲線観測データセット（175個）と銀河回転曲線MiSAKiモデルとの一致を、プロット図による視覚化や調整後決定係数、残差の評価により解析します。また、反重力子の影響を考慮するために、αが負の値をとる場合に生じる虚数成分はnumpy関数を用いて適切に扱い、重力子と反重力子の影響を統合的に評価します。さらに、すべてのフィッティングの完了後に、重力子の集中度を表す変数パラメータα、重力子の効果の範囲を表す変数スケールパラメータR、銀河の観測速度成分、ディスク成分、バルジ成分などの物理パラメータを網羅的に相関分析し、相関係数を算出して相関関係を評価します。また、過剰フィッティングのリスクを考慮し、フィッティング時の変数パラメータは適切な範囲（$-150{,}000 < \alpha < 150{,}000$、$0.1 < R < 200$）に制限して検証を行います。

結果と考察

検証の結果、ほとんどの銀河とモデルの間で、極めて良好なフィッティングが確認されました（調整後決定係数R^2の平均値 0.802、中央値 0.964、標準偏差 0.332）。175個に及ぶ検証数に対して、調整後決定係数R^2の中央値は0.964と高い値を示し、標準偏差は0.332と小さな値を示しました。また、残差の分布はランダムかつ小さな範囲（平均残差 0.110、標準偏差 5.58）に収まっており、過剰フィッティングの兆候は見られませんでした。したがって、本モデルは観測値に対して過剰に適合することなく、銀河の回転曲線を忠実かつ高精度に再現していることが確認されました。また、相関分析の結果、重力子の集中度を表すαが、観測速度およびディスク成分速度と非常に高い正の相関（平均観測速度 Avg Vobs(r) 0.956、平均ディスク速度 Avg Vdisk(r) 0.863）を持つことが確認されました。これは重力子の集中度が銀河の回転速度に強い影響を与えていることを意味し、アインシュタイン方程式により存在が示唆されているダークマターの役割と忠実に一致します。また、分析の結果、αとRの分布はそれぞれ特定の範囲に集中していることが確認されました。αが特定の範囲に集中することは、銀河スケールでの重力子の集中度に一定の基準があることを示唆しています。また、重力子の効果の範囲を表すスケールパラメータRは、αを含む他の物理パラメータに依存せず、一定の範囲に収束していました。これは、重力子の効果が、その集中度や各銀河の物質密度等の特性に依存せず、決められた一定のスケールで作用している可能性を示しています。この結果から、重力子が持つ空間への斥力は物質的な相互作用を示さず、緩やかに減衰しながら球対称に広がり、空間との相互作用を介して銀河外縁部の回転速度維持に貢献していることが明らかになりました。さらに、物質的な相互作用を示さないことは、重力子がヒッグス場と干渉せず、物質に質量を与えるヒッグス粒子との相互作用を示さないことを示唆しています。これは、従来の量子力学において、重力子が質量を持たず、閉じたひもとして次元間の移動が可能であるとする特異な性質の必要条件を満たす可能性があります。また、今回の検証では、αが0や負の値をとることはなく、反重力子の影響は直接的には確認されませんでした。しかし、この結果は反重力子の存在の否定を直接的に意味しません。この理由は、重力子の集中度を表すαの本質が、そこに存在している重力子の絶対数を表すわけではないためです。今回の検証結果より、本研究においては、銀河外縁部の回転速度を維持している謎の力の正体は、「重力子が持つ空間に対する斥力である」と結論付けられました。また、今回の理論モデルの適合性や物質と相互作用しない等の結果から考察し、4つの基本的な力の中で最も弱いとされる重力の正体は、「重力子の空間への斥力に対するエントロピー駆動の空間の反発」であり、重力子の効果と空間の歪みは因果関係にあることを結論付けました。さらに、ダークマターの正

体は、「重力子そのもの」であり、ダークエネルギーの正体は「重力子が持つ空間への斥力」であることが強く示唆されました。これにより、光速を超えるスピードで宇宙を膨張させている謎のエネルギーの正体は、「重力子が持つ空間への斥力である可能性が非常に高い」、と結論付けられます。さらに、質量を持たないとされる重力子が集中するメカニズムは、重力子自身が間接的に発生させる重力、つまり、エントロピー駆動の空間の反発により自身が空間内部に閉じ込められ、その結果として重力子同士が一点に集中していくという、一種の自己因果律のようなものであることが考察されます。そして、このメカニズムは、ブラックホールが持つ事象の地平面の内側だけでなく、物理法則が破れるとされる時空特異点においてもその特性を保っている可能性が考えられます。つまり、ブラックホールは、「重力子の空間に対する斥力を、空間の反発が瞬間的に上回った場合」に形成が開始され、時空特異点は、単なる0次元の点として瞬間的に生じるのではなく、空間が「自ら」内側へ向かって自身を圧縮するような、非常に特殊で複雑な構造と量子的な広がりを持つ時空間領域として形成されていくかもしれません。そして、ある限界を超えた時点で、空間の反発の強さが重力子の斥力の強さへ近づき、最終的に形成された時空特異点は、密度や重力、曲率が無限大とされる0次元の「点」ではなく、「重力子の斥力と、空間の反発が完全に均衡している時空間領域である」と解釈することで、時空特異点において量子効果が働く余地が生まれます。このメカニズムは、従来の量子力学では扱えなかった時空特異点における無限大の問題を回避でき、量子力学の範囲で時空特異点を理解できる可能性を秘めています。しかし、両者が完全に均衡している状態と仮定すると、その時空間領域において量子的な広がりを持つことが不可能になる可能性も懸念されます。これを、量子力学に基づいて柔軟に解釈するためには、閉じたひもであり次元間を移動できるとされる重力子が、時空特異点において別次元空間へ逃げ出している可能性を考慮する必要があるかもしれません。この解釈では、重力子が「開いたひも」の状態から、時空特異点における極端な環境下においては、「閉じたひも」に変化することで、自身をエネルギーに変換し、情報を保持したまま別次元空間へ逃げ出すメカニズムが考えられます。そして、情報を別次元空間へ伝達し、保存する役割を担う「粒子」として機能することで、情報は別次元へ保存され、事象の地平面の内側で消失することがなくなります。この可能性は、近年提案されたソフトヘア理論に加えて、ブラックホール情報パラドックスの解決の糸口になるかもしれません。つまり、時空特異点は、重力子にとっての別次元空間ゲートとして機能している可能性があり、このメカニズムは、ブラックホールの情報パラドックスを解決するとともに、時空特異点における量子的な広がりを許容することになりえます。さらに、このブラックホール形成のメカニズムは、中等度に強い重力場において時間が延長する現象を説明するだけでなく、ブラックホール「内部」の時間の変化までを容易に予測します。事象の地平面付近を含む中等度に強い重力場では、重力子の空間への斥力により空間

が押し広げられることで、プランク長も引き伸ばされ、それに伴い、移動距離の最小単位も長くなることで、量子レベルで物理的移動が遅くなり、その時空間領域における時間が長くなります。これは、「ブラックホール外側の観測者の視点から、物体が事象の地平面に近づくにつれて時間の遅れが生じ、最終的に物体の動きが停止しているかのように見える」という相対性理論の予測と一致します。この現象を、視点を逆にして再現してみると、物体が位置する事象の地平面近くの時空間領域は、重力子の斥力が非常に強く、空間が大きく押し広げられている領域であるため、量子レベルで物理的移動が遅くなり、物体の時間が長くなることによって、相対的に観測者の時間が短くなっていると説明できます。このことから、理論モデルが相対性理論の予測や実際の観測と整合していることが確認できます。しかし、特に注目すべき点は、ブラックホール「内部」において、この関係性が逆転する可能性があるという点です。これは、ブラックホール形成開始の瞬間から空間が自発的なレベルで縮小を続け、それに伴いプランク長が縮められることで、移動距離の最小単位が短くなることに起因します。これにより、事象の地平面内部では量子レベルで物理的移動が速くなり、その時空間領域の時間は短くなります。つまり、ブラックホール「内部」の観測者の視点から見ると、外部の物体が止まって見えると予測され、この予測はブラックホール内部の時間変化に新しい視点を提供する可能性があります。さらに、時間の問題において、観測者の固有時間が常に一定に感じられる現象は、各時空間領域のプランク長や量子スケールでの移動速度に応じて、意識や身体の反応速度が必然的に同期されることにより生じる「時間一定の錯覚」である可能性が考察されます。このような時空間領域レベルの現象は、重力子空間斥力モデル（Re:GraviSモデル）をさらに時空間領域にまで拡張した、重力子時空間斥力モデル（Re:GraviSTモデル：Repulsion Graviton Space-Time Model）として理解する必要があるかもしれません。

結論

今回の研究では、「銀河回転曲線重力子修正逆二乗減衰モデル（銀河回転曲線MiSAKiモデル）」を用いて、SPARC銀河回転曲線観測データセット（175個）との適合を解析しました。その結果、モデルが銀河の観測データと高い整合性を示すことが確認され、重力子が空間への球対称の斥力を持つという仮説を支持する結果が得られました。さらに、重力子の集中度を表すパラメータαの役割が、銀河におけるダークマターの役割の特徴と一致し、かつス

ケールパラメータRが一定の範囲に収束していることが確認されました。これらの結果は、以下の重要な結論と可能性を導きました。

1. 重力子は空間への球対称の斥力を持つ
2. 重力の正体は、重力子の空間への斥力に対するエントロピー駆動の空間の反発である。また、重力が4つの力の中で最弱である理由は、空間を介した間接的なメカニズムに基づいているためである
3. ダークマターの正体は重力子であり、ダークエネルギーの正体は重力子が持つ空間への斥力である
4. 重力子と空間の因果関係により、ブラックホール形成のメカニズムや時空特異点における量子的広がりが説明され、量子力学の範囲で時空特異点の理解が可能となる。また、情報パラドックス解決へ向けた新たな視点が提供される
5. 重力場の強さに依存する時間の遅れを量子力学の範囲で説明可能となる。また、事象の地平面内部では時間が短縮される可能性がある
6. 重力子空間斥力モデル（Re:GraviSモデル）や、理論を時空間まで拡張した重力子時空間斥力モデル（Re:GraviSTモデル）の適用により、これまで困難とされてきた相対性理論と量子力学の統一が可能となる

本研究を通じて得られたこれらの知見は、重力、ダークマター、ダークエネルギーという物理学の根幹に関わる未解決の問題に対して、新たな理解を提供するものです。また、今回の解析結果に基づく、さらなる研究の方向性として次の課題が挙げられます。

1. 理論モデルの追加検証

銀河回転曲線以外の観測データ（重力波や宇宙背景放射等）との整合性を検証することで、理論モデルの妥当性をさらに評価する必要性があること

2. ブラックホール形成メカニズムのさらなる研究

重力子と空間の関係性をブラックホールの形成過程に適用し、観測データやシミュレーション等により詳細に検証する必要性があること

3. ブラックホール時空特異点のさらなる研究

時空特異点における重力子と空間の挙動を詳細にシミュレーションする必要性があること

4. 固有時間の解釈

意識や身体の反応速度が、各時空間領域のプランク長や量子スケールでの移動速度に応じて必然的に同期されることにより「時間一定の錯覚」が生じている可能性について考察し、その物理的背景を検証する必要があること

これらの将来的な検証を通じて、「量子重力理論の完成」に向けた不可欠な基盤として「重力子時空間斥力モデル（Re:GraviSTモデル）」を確立させることが強く期待されます。

参考文献：本研究は独自性が高く、一般的な知見に基づいているため、特定の参考文献はありません。

使用したデータセット：SPARC銀河回転曲線データセット（175個）

https://astronomy.case.edu/2016/08/26/sparc-galaxy-database

銀河回転曲線重力子修正逆二乗減衰モデル（銀河回転曲線 MiSAKi モデル）

$$v_{\text{total}}(r) = \sqrt{\alpha \left(1 - \frac{1}{1 + \left(\frac{r}{R}\right)^2}\right)}$$

- $v_{\text{total}}(r)$：中心からの距離 r における銀河の総回転速度
- α：重力子の集中度を表す変数パラメータ
- R：重力子の影響の範囲を表す変数パラメータ
- r：半径（中心からの距離）

導出過程

1. アインシュタイン方程式

アインシュタイン方程式は、相対性理論における物質分布と時空の曲がり方の関係を記述する基本方程式です。

$$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = \frac{8\pi G}{c^4} T_{\mu\nu} \tag{1}$$

2. シュワルツシルト解の採用

「重力子が空間への球対称な斥力を持つ」という仮定より、アインシュタイン方程式の球対称解であるシュワルツシルト解を採用します。

$$ds^2 = -\left(1 - \frac{2GM}{r}\right) c^2 dt^2 + \left(1 - \frac{2GM}{r}\right)^{-1} dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta \, d\phi^2 \tag{2}$$

3. 円軌道速度式の導出

シュワルツシルト解から、円軌道における速度式を求めると以下の式が得られます。

$$v_{\text{orbit}} = \sqrt{\frac{GM}{r}} \tag{3}$$

4. 新しい仮定に基づく代入

上記の式における $\frac{GM}{r}$ は、中心天体が距離 r の物体に作用する引力を表していますが、ここで、「重力子は、物質と相互作用することなく緩やかに減衰する球対称の空間への斥力を持ち、その強さは重力子の集中度に依存する」と

いう仮説を導入するために、重力子の斥力が近距離で強く働き、遠距離でも緩やかに影響を維持するように、重力子の影響の範囲を表すスケールパラメータ R を用いた修正逆二乗減衰関数を設計し、$\frac{GM}{r}$ の部分を重力子の集中度 α と修正逆二乗減衰関数 $1 - \frac{1}{1+\left(\frac{r}{R}\right)^2}$ の積で表した次の関数で置き換えます。

$$\frac{GM}{r} \to \alpha \left(1 - \frac{1}{1 + \left(\frac{r}{R}\right)^2}\right) \tag{4}$$

この式は、重力子の空間への球対称の斥力が、距離 r に応じて修正逆二乗則に従いながら減衰する様子を表しています。これで、元の円軌道速度式の構造的な意味を保持しつつ、仮説を式に反映させることが可能となります。

5. 最終的に導かれた式

上記の代入を適用した結果、銀河回転曲線を再現する最終的な円軌道速度式は次の形に導かれます。

$$v_{\text{total}}(r) = \sqrt{\alpha \left(1 - \frac{1}{1 + \left(\frac{r}{R}\right)^2}\right)} \tag{5}$$

- $v_{\text{total}}(r)$：中心からの距離 r における銀河の総回転速度
- α：重力子の集中度を表す変数パラメータ
- R：重力子の影響の範囲を表す変数パラメータ
- r：半径（中心からの距離）

反重力子の影響も考慮するために、α が負の場合に現れる虚数成分は無視せず、numpy 関数で適切に取り扱います。

Fitting Results Table with Average Parameters

Galaxy	Alpha	R	R^2	Avg_Radius	Avg_Vobs	Avg_errV	Avg_Predicted_Velocity	Avg_Residual	Residual_Std_Dev	Avg_Vdisk	Avg_Vgas	Avg_Vbul	Avg_SBdisk	Avg_SBbul
CamB_rotmod	2210.458	3.783776	0.999017	0.9233333	10.87667	1.5	10.89804618	-0.02137951	0.182383624	12.74	6.48	0	11.882222	0
D512-2_rotmod	1553.504	1.289073	0.963444	2.3975	32.375	3.8975	32.39893999	-0.02393999	1.242459275	19.1725	6.465	0	7.09	0
D564-8_rotmod	793.3307	1.594271	0.999021	1.7883333	19.05667	1.75	19.06036862	-0.00370195	0.195194545	8.113333	6.015	0	1.8533333	0
D631-7_rotmod	4317.117	3.489839	0.992485	3.818125	43.03813	2.44063	42.94638123	0.091743766	1.357026671	15.2225	17.9475	0	4.180625	0
DDO064_rotmod	3495.151	1.784168	0.958088	1.3992857	32.535	5.07786	32.31496019	0.220039809	3.015548075	15.10429	10.35786	0	11.647143	0
DDO154_rotmod	2603.474	2.076227	0.987103	3.2083333	38.18333	0.625	38.10278114	0.080552191	1.285813309	9.485	14.01667	0	1.9258333	0
DDO161_rotmod	4824.581	4.250858	0.970902	6.3877419	49.25484	2.34677	48.64029733	0.614541376	2.956133919	18.86387	25.20968	0	6.0625806	0
DDO168_rotmod	3956.083	2.087818	0.96688	2.266	41.46	1.94	41.33529533	0.12470467	2.659847363	15.367	20.458	0	6.114	0
DDO170_rotmod	4172.97	3.801255	0.994259	7.09875	52.25	1.3875	52.28312327	-0.03312327	0.884738741	18.02875	21.895	0	2.07875	0
ESO079-G014_rotmod	37823.77	6.815856	0.969044	7.174	119.3867	5.71867	117.0561581	2.330508567	8.700951744	95.588	17.35333	0	123.336	0
ESO116-G012_rotmod	13398.42	2.623518	0.982282	4.7273333	86.74667	3.13467	86.0702916	0.676375064	3.828555368	53.40267	19.22733	0	55.321333	0
ESO444-G084_rotmod	4185.995	1.142483	0.985373	2.04	48.28571	3.21571	47.95358152	0.332132765	1.948366069	11.72571	14.79286	0	6.6314286	0
ESO563-G021_rotmod	108091.8	6.550686	0.97625	18.994667	263.31	9.09133	264.5345945	-1.22459445	13.70154806	219.415	25.07133	0	273.68267	0
F561-1_rotmod	2911.844	3.089149	0.988565	5.6416667	43.25	5.83333	43.31263877	-0.06263877	1.113024005	41.21	17.94333	0	16.671667	0
F563-1_rotmod	12008.86	3.440473	0.930814	9.3047059	88.95294	13.5282	89.29376684	-0.34082567	6.782570104	26.28412	20.65647	0	6.3341176	0
F563-V1_rotmod	985.7857	2.691161	0.918356	4.5883333	24.61667	5	24.71183441	-0.09516774	1.937115293	20.40333	13.87667	0	6.2766667	0
F563-V2_rotmod	15106.96	2.445338	0.98923	4.898	86.15	18.232	86.65328704	-0.50328704	4.001410182	32.626	19.396	0	27.042	0
F565-V2_rotmod	9336.22	5.249745	0.997321	5.03	60.47143	7.42857	60.57082044	-0.09939186	1.150216408	17.98571	17.52286	0	3.7528571	0
F567-2_rotmod	2922.527	2.977671	0.92821	5.752	44.32	7.2	44.40107821	-0.08107821	2.66691396	31.162	3.898	0	8.59	0
F568-1_rotmod	20454.02	3.8823	0.996541	5.8183333	100.8833	12.4817	100.9657193	-0.08238592	2.293635569	40.60333	15.7875	0	25.3025	0
F568-3_rotmod	13725.24	5.244496	0.978399	6.6611111	74.81667	8.80389	75.16468207	-0.3480154	4.70537816	41.65667	14.545	0	24.663333	0
F568-V1_rotmod	14069.72	2.675238	0.993927	6.3493333	94.81333	16.28	94.85009207	-0.03675874	2.276224101	39.19667	13.11	0	20.502667	0
F571-8_rotmod	21587.31	4.435682	0.97466	5.4923077	94.16154	5.12308	92.65832977	1.503208687	6.328024763	82.89846	7.603846	0	243.75385	0
F571-V1_rotmod	8273.395	4.850916	0.995559	7.7728571	69.74286	7.28571	69.83922082	-0.09636367	1.272182958	30.40143	22.65429	0	6.0214286	0
F574-1_rotmod	10488.42	3.172759	0.999084	6.5742857	80.74286	4.6	80.73848762	0.004369519	0.765557587	44.21143	13.08	0	23.728571	0
F574-2_rotmod	2604.549	8.688131	0.999024	6.492	28.32	8.8	28.28938982	0.030610179	0.338280309	30.722	10.208	0	8.534	0
F579-V1_rotmod	12527.88	1.36528	0.984067	6.4607143	100.5571	11.8214	100.4391305	0.118012378	2.611163899	60.175	13.11429	0	44.320714	0
F583-1_rotmod	8195.726	4.411722	0.991076	4.7336	53.264	7.5164	53.05540819	0.208591814	2.346658335	20.4036	7.4496	0	9.2412	0
F583-4_rotmod	4504.928	2.086378	0.970161	4.0416667	51.23333	4.95	50.87365003	0.359683302	3.150214291	32.4725	8.598333	0	20.280833	0
IC2574_rotmod	7055.929	8.26478	0.978935	5.5444118	43.47647	3.24118	43.20165368	0.274816912	2.405808597	22.48412	13.90735	0	4.9655882	0
IC4202_rotmod	63898.41	3.887482	0.973076	12.807188	219.7188	7.3675	220.3584077	-0.63965771	8.491881353	165.6581	26.15563	120.974	129.87438	148.32906
KK98-251_rotmod	2235.74	2.559089	0.983523	1.48	21.58333	2	21.71947833	-0.136145	1.327731553	9.040667	11.75267	0	4.2046667	0
NGC0024_rotmod	12486.23	1.092277	0.986871	2.5489655	84.65862	7.61621	84.83781329	-0.1791926	2.924749271	53.56448	12.13172	0	128.74586	0
NGC0055_rotmod	8708.065	4.450001	0.989265	7.3657143	72.25238	3.8619	72.17349173	0.078889218	1.898410675	40.49286	33.53048	0	12.447143	0
NGC0100_rotmod	8716.182	3.2373	0.995933	4.937619	67.34333	5.56429	67.26778897	0.075544366	1.539482328	44.40095	10.88571	0	30.564286	0
NGC0247_rotmod	11458.16	4.262198	0.912591	7.8053846	85.17308	5.00385	84.65748739	0.515589537	5.918498704	48.61308	22.60692	0	17.456923	0
NGC0289_rotmod	29950.37	0.1	-0.00017	31.7475	173.0357	11.59	173.0356539	6.04E-05	9.678908912	125.7196	43.53571	0	109.10857	0
NGC0300_rotmod	9145.655	2.677627	0.971142	6.3532	80.664	6.464	80.59065506	0.073344942	2.834361255	43.3308	16.5384	0	15.6932	0
NGC0801_rotmod	50891.09	1.431467	0.750103	22.513846	207.4615	5.28462	207.7578885	-0.29635002	17.21844651	218.8808	33.62	0	729.83154	0
NGC0891_rotmod	48199.2	0.1	-0.01811	9.2483333	219.4444	4.495	219.4407147	0.003729782	9.611221657	237.9839	18.04889	110.909	389.13333	76.371667
NGC1003_rotmod	11592.77	3.355035	0.896385	15.749444	99.03056	2.89722	98.88782303	0.142732521	4.852848065	49.30167	26.66472	0	12.88	0
NGC1090_rotmod	28542.46	2.740539	0.973714	15.198333	149.9958	4.55167	150.0713438	-0.07551051	6.338544737	134.8088	25.90583	0	158.92208	0
NGC1705_rotmod	5165.02	0.235732	0.910233	3.1107143	69.65	5.74929	69.64054364	0.009456361	1.85703555	29.65357	14.15071	0	45.336429	0
NGC2366_rotmod	3111.185	2.001128	0.976383	3.0903846	40.49269	2.60731	40.58045171	-0.0877594	2.267027025	17.45077	18.53692	0	8.3938462	0
NGC2403_rotmod	16460.46	1.568216	0.904845	7.0090411	107.9973	2.42082	107.0925478	0.904712428	8.110655109	77.97288	23.5326	0	152.34479	0
NGC2683_rotmod	31559.56	0.1	-0.00097	18.099091	177.6364	9	177.6350801	0.001283512	22.74983922	152.5309	19.71273	43.0318	89.216364	0
NGC2841_rotmod	90866.08	0.1	-0.00079	23.2606	301.42	7.6702	301.4196319	0.000368131	16.93037079	181.0286	40.3046	123.045	138.8096	0.4342
NGC2903_rotmod	39358.78	1.092896	0.81549	10.362353	182.7059	4.02941	183.2272783	-0.52139594	16.22911966	198.7688	22.91765	0	695.72265	0
NGC2915_rotmod	7363.062	1.638209	0.942734	5.1866667	74.11667	8.06433	74.31295234	-0.19628567	4.31353993	27.20067	14.873	0	16.459333	0
NGC2955_rotmod	68126.79	0.989951	0.735151	12.25125	252.125	8.71375	252.0550779	0.069922117	12.74500814	209.4958	37.90083	175.13	356.58375	382.07083
NGC2976_rotmod	16002.31	2.150245	0.987956	1.0366667	51.15926	3.50519	51.13397104	0.025288218	2.765915519	51.22667	13.64741	0	228.18741	0
NGC2998_rotmod	43794.64	1.283679	0.876404	16.072308	187.0769	8.76923	185.3566107	1.720312337	14.14852461	154.9508	31.72385	0	455.52308	0
NGC3109_rotmod	6082.007	3.828293	0.996996	3.3532	45.764	2.752	45.72524449	0.038755511	1.033297759	12.3892	13.8656	0	2.972	0
NGC3198_rotmod	23627.13	3.297732	0.978206	13.886279	125.6721	5.04302	125.2808867	0.391206316	5.267032896	100.3458	20.4886	0	128.29349	0
NGC3521_rotmod	46626.26	0.593666	0.909982	4.7143902	207.439	13.4924	207.4391319	-0.00010749	4.798148027	250.331	8.892439	0	908.00561	0
NGC3726_rotmod	27970.53	4.2866	0.863241	15.790833	151.8333	6.87083	151.8889124	-0.05557905	7.432580018	145.6333	30.91333	0	73.666667	0
NGC3741_rotmod	2587.856	2.096111	0.891398	3.0685714	36.18095	2.3019	35.46473281	0.716219569	3.736444762	7.678571	10.40857	0	2.3961905	0
NGC3769_rotmod	14604.08	1.644249	0.810796	15.345	115.875	7.8	115.8803946	-0.00539464	4.582873614	88.335	31.08917	0	43.648333	0
NGC3877_rotmod	32915.52	3.119671	0.982782	6.1084615	144.0692	6.37692	144.654567	-0.58533621	5.38494249	164.2731	17.99077	0	250.62769	0
NGC3893_rotmod	34112.48	1.276172	0.610589	10.197	178.6	8.46	178.6182959	-0.0182959	9.000801427	167.431	37.352	0	161.03	0
NGC3917_rotmod	21610.84	4.190154	0.987462	7.8541176	114.8529	4.21176	115.2395125	-0.38657129	3.833702924	89.67647	19.10941	0	59.125882	0
NGC3949_rotmod	29098.45	1.680805	0.984625	4.3771429	153.1429	9.9	153.135643	0.007214102	1.924182116	176.25	28.80286	0	249.29143	0
NGC3953_rotmod	51711.93	2.58841	0.913934	9.59	213.625	6.65	213.6352224	-0.01022237	4.401761368	229.885	16.2725	0	191.0275	0
NGC3972_rotmod	19603.97	3.120932	0.988581	4.799	105.1	5.01	104.8779667	0.222033289	3.242597595	85.324	17.801	0	86.105	0
NGC3992_rotmod	64348.63	0.1	-8.94E-05	27.562222	253.6667	6.42222	253.6666363	3.04E-05	13.92003284	202.1767	35.87667	0	46.166667	0
NGC4010_rotmod	19540.73	4.385368	0.961206	5.6716667	98.8	5.45833	98.18794702	0.612052982	6.141366675	87.11833	23.09583	0	81.975833	0
NGC4013_rotmod	31834.39	0.1	-0.00093	18.242222	178.4167	5.69444	178.4163745	0.000292139	10.74177548	139.4983	27.24056	65.415	25.241667	0.3511111
NGC4051_rotmod	23912.09	1.706329	0.574562	6.9771429	143.5714	8.37143	143.4532902	0.118138394	12.06669831	169.4786	18.61714	0	180.33286	0
NGC4068_rotmod	5176.949	3.256402	0.99878	1.2716667	24.76333	2.98667	24.80295189	-0.03961855	0.49114654	19.155	10.37167	0	19.611667	0
NGC4085_rotmod	22940.64	2.676353	0.987349	3.5528571	108.5857	5.87143	108.9451628	-0.35944856	3.927359952	137.1043	16.45857	0	276.69429	0
NGC4088_rotmod	31838.79	2.857073	0.910688	11.386667	162.1583	7.50833	162.3397177	-0.18138433	8.103958434	198.8975	38.2375	0	191.55667	0
NGC4100_rotmod	33034.98	2.086781	0.330938	12.664583	175.2917	6.27083	175.3475511	-0.0558844	14.79904193	149.6213	27.60042	0	75.075833	0
NGC4138_rotmod	27421.81	0.1	-0.00218	10.632857	165.5714	14.3143	165.5692553	0.00217326	19.63305398	136.1329	19.81286	67.5114	75.902857	0
NGC4157_rotmod	36475.67	2.414218	0.814476	15.681765	180.7882	8.52941	180.9680806	-0.17984532	10.23279121	179.1465	39.94412	28.6694	147.08882	0.0005882
NGC4183_rotmod	12630.09	2.466577	0.955957	10.636957	101.9	5.96087	101.7080108	0.191989203	3.615524342	62.81435	29.89652	0	24.853913	0
NGC4214_rotmod	6060.641	0.242317	0.656377	2.9221429	75.22143	6.63357	75.17563366	0.045794913	4.740726049	42.48286	13.76643	0	63.625714	0
NGC4217_rotmod	36389.35	2.470148	0.947009	8.7384211	168.6158	7.10789	169.0973483	-0.48155882	8.331298459	79.49053	24.49895	187.557	43.693158	420.26474
NGC4389_rotmod	20723.9	4.793777	0.991471	3.1116667	73.1	6.58333	72.7820669	0.317933097	2.754330111	128.58	13.91333	0	291.81	0
NGC4559_rotmod	14903.21	2.502733	0.961786	10.800313	110.4906	5.45031	110.2104863	0.280138684	3.739442463	89.63375	32.11219	0	57.146563	0

NGC5005_rotmod	66550.7	0.396295	0.646557	5.325	252.2778	21.2372	252.2436068	0.034171016	9.613871304	244.4211	63.50667	152.914	964.70556	662.97222
NGC5033_rotmod	44854.74	0.157265	0.006304	21.162727	211.5455	4.59091	211.5454934	-3.88E-05	11.83376409	144.7077	37.18864	96.6423	184.18909	164.36864
NGC5055_rotmod	36801.3	0.812704	0.569942	20.879643	187.25	3.35607	187.2654057	-0.01540569	11.37905678	202.3775	29.10857	0	404.14036	0
NGC5371_rotmod	49312.71	0.409792	0.023339	21.353158	221.3684	4.10526	221.3682174	0.000203614	12.34431079	245.6853	30.58053	0	244.00316	0
NGC5585_rotmod	8523.813	2.422593	0.938292	4.1520833	62.1875	2.22333	60.51120343	1.676296566	6.354160661	44.59792	14.97375	0	94.121667	0
NGC5907_rotmod	49144.03	0.439037	0.000648	27.68	221.5789	3.57895	221.5789538	-6.42E-06	8.130395513	177.4289	43.78684	0	53.81	0
NGC5985_rotmod	89402.86	3.144581	0.83058	16.082121	285.4545	6.09424	285.4755966	-0.02105119	8.129909517	193.3982	16.07	58.907	113.49121	0.0321212
NGC6015_rotmod	24750.44	1.638374	0.953891	12.398636	143.2182	3.93182	143.1003934	0.117788464	5.829020407	103.5695	24.72023	0	132.17591	0
NGC6195_rotmod	62180.94	1.201659	0.791319	14.176087	243.087	7.27435	243.1126874	-0.02573089	7.485853706	189.2204	35.10913	191.784	198.60652	253.64565
NGC6503_rotmod	13645.12	0.84132	0.906513	12.140968	114.2903	2.35484	114.2973247	-0.00700209	2.372564515	76.97871	22.65806	0	56.950323	0
NGC6674_rotmod	64087.82	1.544108	0.219532	37.467333	249.9333	8.26667	249.9513681	-0.01803481	19.12476652	161.1887	32.718	57.9667	75.556667	0.7893333
NGC6789_rotmod	9240.938	0.89293	0.99016	0.405	37.725	5.315	37.20470316	0.52029684	1.911090752	16.67	8.365	0	58.86	0
NGC6946_rotmod	26813.53	0.105252	0.028455	10.275517	163.2931	6.24138	163.2895955	0.003507938	14.51220063	154.9064	28.97241	54.5884	195.24379	95.575517
NGC7331_rotmod	58544.44	0.22051	0.000527	18.055556	241.8611	5.13889	241.8611185	-7.39E-06	8.213335815	262.9008	35.78	63.9536	242.20389	0
NGC7793_rotmod	11052.01	0.997863	0.926744	2.3147826	74.45652	6.93478	73.76944044	0.687081296	8.300140639	69.88326	13.97087	0	312.33783	0
NGC7814_rotmod	50524.26	0.1	-0.07687	10.065	224.6111	5.61056	224.5788244	0.032286698	14.46316444	96.745	10.335	171.889	75.380556	426.38167
PGC51017_rotmod	373.2065	0.1	-0.68741	1.98	19.16667	2.25667	19.15192607	0.014740592	1.183812004	16.62167	11.39	0	10.648333	0
UGC00128_rotmod	16983.29	5.407011	0.979559	27.512727	118.4273	2.63545	118.2541209	0.173151792	3.29976233	44.28045	30.51318	0	7.2718182	0
UGC00191_rotmod	7043.906	1.738069	0.985976	3.3666667	58.97778	2.29667	59.00055182	-0.02277405	2.39196571	33.56667	13.52778	0	39.887778	0
UGC00634_rotmod	13308.88	5.833366	0.988819	11.26	95.7375	2.2725	95.76649098	-0.02899098	1.899036808	36.33	32.16	0	3.185	0
UGC00731_rotmod	5622.306	2.70381	0.956549	5.91	61.78333	2.79667	61.52153533	0.261798006	2.937612256	13.185	21.3475	0	1.8066667	0
UGC00891_rotmod	5316.684	4.053389	0.999266	4.446	49.19	1.284	49.23384433	-0.04384433	0.426795431	18.356	18.79	0	3.304	0
UGC01230_rotmod	12159.58	3.272532	0.949442	13.692727	91.88182	11.3727	92.34764459	-0.46582641	6.416861201	42.39364	25.99818	0	18.681818	0
UGC01281_rotmod	4898.681	3.034268	0.992345	2.072	34.4312	4.8948	34.67666751	-0.24546751	1.55196941	15.7776	7.4136	0	10.0676	0
UGC02023_rotmod	10898.6	5.680342	0.994175	2.27	37.48	8.69	37.27486756	0.205132443	1.275854085	31.256	11.8	0	26.198	0
UGC02259_rotmod	7791.942	1.325097	0.967377	4.58125	79.8375	2.2125	79.79604431	0.041455686	2.021332351	36.25875	18.05875	0	14.94375	0
UGC02455_rotmod	7109.194	4.364588	0.918991	2.26375	37.375	3.64	36.44104651	0.933953485	4.121261104	67.91375	16.8775	0	114.21875	0
UGC02487_rotmod	126069.8	0.1	-0.00038	41.086471	355.0588	6.98235	355.0585963	0.00022722	21.37709592	216.0247	25.61706	124.368	68.601176	3.4958824
UGC02885_rotmod	81725.35	0.1	-0.00296	38.269474	285.8421	10	285.8411656	0.000939694	13.6961017	191.4679	48.85632	98.2158	117.53474	70.172105
UGC02916_rotmod	44044.58	0.212884	0.195427	10.053023	208.7209	8.18349	208.7205683	0.000361915	8.904045367	87.89907	24.96023	195.499	78.455814	631.33465
UGC02953_rotmod	75905.15	0.1	0.068451	14.996174	273.8609	6.85061	273.8018777	0.058991827	27.41397961	213.2462	7.528348	145.675	792.74113	1119.2974
UGC03205_rotmod	50802.77	0.961297	0.815244	11.525833	215.125	7.54521	214.6081275	0.516872516	12.43021628	160.4963	14.60208	97.2083	201.93833	258.59104
UGC03546_rotmod	45058.11	0.1	-0.05397	8.833	212	15.5267	211.9545741	0.045425904	19.5533731	159.68	10.79433	180.201	575.02567	197.024
UGC03580_rotmod	11789.17	1.222001	0.385252	6.1942553	91.70213	5.18596	89.10018109	2.601946565	16.45152982	68.36723	15.52489	64.9047	158.65617	272.64128
UGC04278_rotmod	14195.61	5.802917	0.950907	3.4596	56.8812	6.0452	55.59175419	1.289445806	5.365199748	30.1088	4.5512	0	19.5736	0
UGC04305_rotmod	1290.291	1.08231	0.873779	2.8859091	30.085	3.56	30.32600699	-0.24100699	3.123987377	28.02136	15.42636	0	18.000909	0
UGC04325_rotmod	9373.457	1.383062	0.988561	3.1425	81.05	3.0525	81.1458168	-0.0958168	1.909143838	41.7125	19.0075	0	31.77875	0
UGC04483_rotmod	682.1311	0.476727	0.988696	0.64625	18.27625	1.7975	18.23246828	0.043781715	0.734787243	8.1325	8.60875	0	8.98875	0
UGC04499_rotmod	6050.694	2.586214	0.998358	4.5466667	60.88889	2.94889	60.87185895	0.01702994	0.654645067	34.90111	20.69444	0	13.78	0
UGC05005_rotmod	10910.72	8.122084	0.990123	11.698182	69.67273	12.8736	69.09304962	0.579677654	2.836509251	34.67	22.47	0	11.720909	0
UGC05253_rotmod	59036.34	0.1	-0.20021	9.7146575	241.7808	5.95123	241.6640864	0.116735475	10.40095833	124.2797	14.97274	211.814	301.27301	1622.1173
UGC05414_rotmod	4833.036	2.34765	0.996623	2.395	45.18333	2.45167	45.09687411	0.086459226	0.881425505	30.34167	15.74833	0	23.925	0
UGC05716_rotmod	5375.157	2.198769	0.896157	6.7133333	64.44167	1.25667	64.21418434	0.227482324	3.699928813	20.7325	20.42667	0	4.0533333	0
UGC05721_rotmod	6573.201	0.625637	0.936771	2.7113043	70.33478	5.34478	70.08312133	0.251661274	4.294350159	31.53826	17.10043	0	62.155217	0
UGC05750_rotmod	7651.331	6.920318	0.990678	6.7936364	48.7	8.53636	49.06496231	-0.36496231	2.466403973	27.30545	14.86636	0	11.105455	0
UGC05764_rotmod	3109.953	0.93284	0.940818	1.993	45.77	1.302	45.7573719	0.012628099	2.724183686	10.619	14.619	0	3.903	0
UGC05829_rotmod	5796.613	4.170415	0.966362	3.7709091	46.36364	5.06	45.87916713	0.484469229	3.033903656	18.38364	15.44455	0	5.7263636	0
UGC05918_rotmod	2072.076	1.500951	0.991455	2.5075	35.2875	3.93	35.22863116	0.058868845	0.852359304	14.42625	9.15875	0	5.08125	0
UGC05986_rotmod	14596.78	2.475162	0.96372	5.0213333	96.74	3.26733	96.89393138	-0.15393138	5.127271871	58.738	16.47933	0	41.6	0
UGC05999_rotmod	12035.61	6.94808	0.988484	10.19	83.24	5	83.37907295	-0.13907295	2.351995091	37.54	30.084	0	5.446	0
UGC06399_rotmod	8972.354	3.139692	0.998646	4.3633333	68.75556	4.96667	68.78173343	-0.02617787	0.786722607	38.74333	15.74222	0	19.098889	0
UGC06446_rotmod	6840.387	1.573945	0.947493	5.2876471	72.96471	5	72.83605965	0.128646234	3.211918564	27.66706	21.01882	0	9.9470588	0
UGC06614_rotmod	34714.41	0.1	-9.85E-05	23.960769	186.3077	14.1	186.3076377	5.46E-05	14.76207619	93.23692	9.491538	131.89	28.785385	28.653077
UGC06628_rotmod	1884.872	1.343061	0.991219	4.3957143	39.1	8.27	39.11099001	-0.01099001	0.524415253	41.86286	15.11143	0	22.937143	0
UGC06667_rotmod	8766.028	3.166796	0.995845	4.3633333	67.86667	3.41111	67.78022251	0.08644416	1.337943328	17.28111	15.44889	0	5.6566667	0
UGC06786_rotmod	46397.07	0.189865	0.453396	9.7124444	212.3778	7.27356	212.308921	0.068856808	12.08181792	126.8058	15.74111	114.816	175.62244	746.68511
UGC06787_rotmod	58577.09	0.134515	0.379965	10.022676	239.6479	6.79	239.7012568	-0.0533695	14.77332431	106.2089	11.46789	188.655	170.42704	1992.6196
UGC06818_rotmod	9120.805	5.469584	0.946288	3.9275	51.5875	5.15625	51.07123222	0.516267777	4.68756082	37.4575	11.99625	0	19.27	0
UGC06917_rotmod	12657.45	3.025393	0.98376	6.1081818	94.17273	4.16364	94.12099221	0.051735059	2.079793723	61.76909	19.17818	0	25.605455	0
UGC06923_rotmod	7666.41	2.052615	0.953598	3.1816667	67.7	5.375	67.51418014	0.185819858	3.581944574	53.895	21.96333	0	41.45	0
UGC06930_rotmod	12128.89	3.024072	0.992379	9.507	97.56	6.45	97.5565237	0.003476302	1.477164897	60.381	27.712	0	19.269	0
UGC06973_rotmod	30746.84	0.478192	0.252283	5.09	173.7778	5.68889	173.7775978	0.00018001	3.314707301	221.3067	24.40778	85.4267	312.07778	0.0011111
UGC06983_rotmod	12398.89	2.554206	0.943483	8.7252941	101.1647	6.09412	101.197951	-0.03324516	3.223098594	52.49353	25.62118	0	13.722941	0
UGC07089_rotmod	7105.049	4.198667	0.983029	5.3083333	59.79167	5.19167	59.49762876	0.294037905	2.354097852	44.10917	18.01333	0	20.259167	0
UGC07125_rotmod	4381.008	3.729451	0.973329	10.076923	56.73846	2.61615	56.63900578	0.099455758	1.922549666	33.66769	26.21615	0	7.5507692	0
UGC07151_rotmod	5842.869	1.419327	0.985053	2.9981818	62.30909	2.60455	62.37037586	-0.06128495	1.919733734	44.71818	14.14182	0	42.109091	0
UGC07232_rotmod	4014.233	0.880743	0.986965	0.515	30.45	3.3	30.26940346	0.180596545	1.337371285	22.6475	8.33	0	58.6325	0
UGC07261_rotmod	5678.794	1.242797	0.973868	3.81	67.2	5.66	67.17462259	0.025377408	1.634545893	42.58857	13.89	0	24.645714	0
UGC07323_rotmod	9951.788	3.639159	0.97134	3.201	60.1	3.87	59.41080663	0.68919337	3.569068787	49.91	12.33	0	50.953	0
UGC07399_rotmod	10620.42	1.291803	0.975878	3.373	88.32	3.379	88.20411688	0.11588312	2.747118288	34.448	18.107	0	22.428	0
UGC07524_rotmod	7207.789	3.596594	0.980573	5.516129	62.73871	3.49032	62.28101678	0.457692898	2.647730165	31.86581	18.06935	0	12.253226	0
UGC07559_rotmod	1442.049	1.529353	0.996722	1.4442857	23.65857	3.23	23.6266179	0.031953532	0.489252727	15.19143	9.788571	0	9.3114286	0
UGC07577_rotmod	843.3762	2.291017	0.982974	0.9422222	10.68889	3.17	10.53200801	0.15688088	0.60208493	10.07889	4.508889	0	6.9844444	0
UGC07603_rotmod	4410.197	1.162531	0.990131	2.2225	52.71667	2.89	52.70844993	0.008216742	1.407037036	26.41667	13.14333	0	19.698333	0
UGC07608_rotmod	6269.009	2.820587	0.993368	2.6875	49.225	6.69	49.30178264	-0.07678264	1.508156971	15.0275	14.01625	0	5.315	0
UGC07690_rotmod	3521.672	0.444261	0.710172	2.36	56.47143	4.31	56.48422894	-0.01280036	2.795054086	40.80857	16.61429	0	35.411429	0
UGC07866_rotmod	1150.77	0.972724	0.972246	1.33	24.77143	4.07	24.67807152	0.093357056	1.182028943	15.24714	8.59	0	10.847143	0
UGC08286_rotmod	7258.981	1.52848	0.992411	4.2564706	72.77647	2.21647	72.86863239	-0.0921618	1.454766498	32.81529	15.66471	0	16.096471	0
UGC08490_rotmod	6327.073	0.753303	0.962462	5.2426667	75.15667	3.69	75.09487897	0.0617877	1.819323807	31.71467	20.286	0	18.420333	0
UGC08550_rotmod	3222.579	0.965771	0.963653	2.9245455	49.78182	2.12364	49.7837361	-0.00191792	1.803346562	21.41545	13.22273	0	10.117273	0
UGC08699_rotmod	34452.38	0.152434	0.293073	7.7792683	184.1707	7.64951	184.172195	-0.00146327	8.441254358	117.1856	20.07976	119.33	231.83195	713.68951
UGC08837_rotmod	7279.005	5.825274	0.992115	2.36125	30.48875	2.53875	30.61072294	-0.12197294	1.349325782	22.32125	10.45125	0	12.58	0

UGC09037_rotmod	25128.78	5.549982	0.959671	15.198182	137.9273	7.23091	137.9297642	-0.00249146	5.038571585	133.8018	48.23864	0	56.964545	0
UGC09133_rotmod	69930.48	0.1	-0.02382	30.110588	264.1765	5.94382	264.1470325	0.0294381	24.08950572	169.375	30.46574	168.779	265.53074	679.11794
UGC09992_rotmod	1154.643	0.546297	0.955462	2.336	32.02	5.66	32.0182487	0.001751295	0.516376247	22.262	13.268	0	11.006	0
UGC10310_rotmod	5887.552	2.192953	0.995664	4.42	62.74286	5.06	62.79480316	-0.05194602	0.952092865	35.38429	18.43	0	15.16	0
UGC11455_rotmod	82092.02	5.728508	0.968982	15.364722	228.2444	7.75556	228.2703069	-0.02586246	12.2402897	249.5939	21.97472	0	396.47528	0
UGC11557_rotmod	9052.717	4.490537	0.981498	4.565	57.31667	7.875	57.78940712	-0.47274045	3.695726741	74.6275	11.3125	0	98.580833	0
UGC11820_rotmod	5766.035	1.552831	0.944763	5.576	51.205	2.938	51.02797629	0.17702371	6.205665124	19.477	16.072	0	29.292	0
UGC11914_rotmod	84855.38	0.440993	0.940862	3.726	279.5231	9.74015	279.5048667	0.0182102	6.114444792	204.6392	9.179692	202.966	859.68077	1058.4545
UGC12506_rotmod	57513.04	2.546488	0.855751	25.406452	228.871	14.4484	228.3227272	0.548240567	11.41613348	140.4713	51.12161	0	60.566774	0
UGC12632_rotmod	5547.564	2.755229	0.985445	5.6866667	60.18667	3.56067	59.98395775	0.202708921	1.810224101	26.414	17.538	0	7.504	0
UGC12732_rotmod	8128.786	3.323883	0.911591	8.1625	75.75	3.62688	75.35639905	0.393600949	5.024140739	29.31188	20.67063	0	6.880625	0
UGCA281_rotmod	1046.985	0.461573	0.996247	0.5785714	22.11429	1.78	22.05844032	0.055845393	0.511977967	14.29571	7.062857	0	36.737143	0
UGCA442_rotmod	3846.251	2.285353	0.989286	3.375	44.7875	2.00375	44.58189554	0.205604459	1.631804162	11.2475	17.46875	0	2.7425	0
UGCA444_rotmod	1557.182	1.21903	0.977357	1.3663889	26.23556	3.90861	26.0496576	0.185897955	1.332897136	4.521667	12.04167	0	0.9616667	0

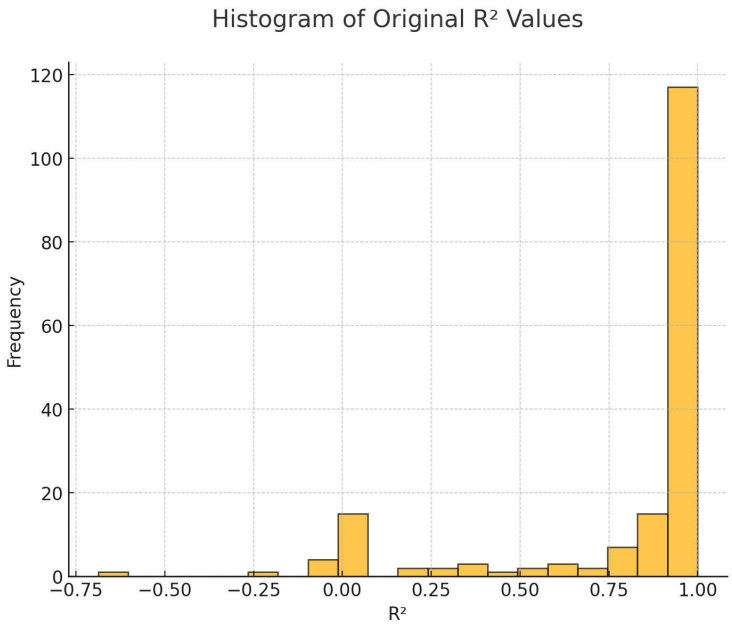
Summary Statistics

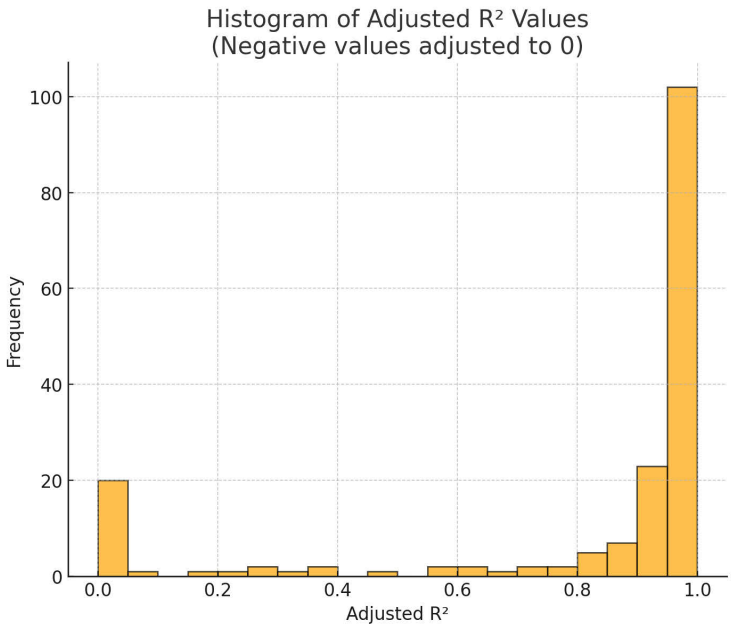
	count	mean	std	min	25%	50%	75%	max	25th Percentile	75th Percentile
Alpha	175	21502.130	23706.282	373.206	5650.550	11458.156	31696.972	126069.768	5650.550	31696.972
R	175	2.379	1.862	0.100	0.969	2.096	3.311	8.688	0.969	3.311
R^2	175	0.796	0.351	-0.687	0.859	0.964	0.988	0.999	0.859	0.988
Avg_Radius	175	8.371	7.599	0.405	3.281	5.672	10.498	41.086	3.281	10.498
Avg_Vobs	175	108.751	76.537	10.689	50.471	80.664	167.094	355.059	50.471	167.094
Avg_errV	175	5.770	3.397	0.625	3.284	5.186	7.280	21.237	3.284	7.280
Avg_Predicted_Velocity	175	108.641	76.599	10.532	50.329	80.591	167.333	355.059	50.329	167.333
Avg_Residual	175	0.110	0.434	-1.225	-0.033	0.008	0.175	2.602	-0.033	0.175
Residual_Std_Dev	175	5.577	5.419	0.182	1.838	3.300	8.130	27.414	1.838	8.130
Avg_Vdisk	175	79.166	70.220	4.522	26.415	44.211	134.305	262.901	26.415	134.305
Avg_Vgas	175	19.716	9.891	3.898	13.398	17.538	24.840	63.507	13.398	24.840
Avg_Vbul	175	22.289	52.434	0.000	0.000	0.000	0.000	211.814	0.000	0.000
Avg_SBdisk	175	104.221	171.701	0.962	10.927	29.292	128.520	964.706	10.927	128.520
Avg_SBbul	175	68.717	255.214	0.000	0.000	0.000	0.000	1992.620	0.000	0.000

R^2 Summary Statistics

Metric	Original R^2	Adjusted R^2
Mean	0.796	0.802
Median	0.964	0.964
Standard Deviation	0.351	0.332
Min	-0.687	0.000
Max	0.999	0.999

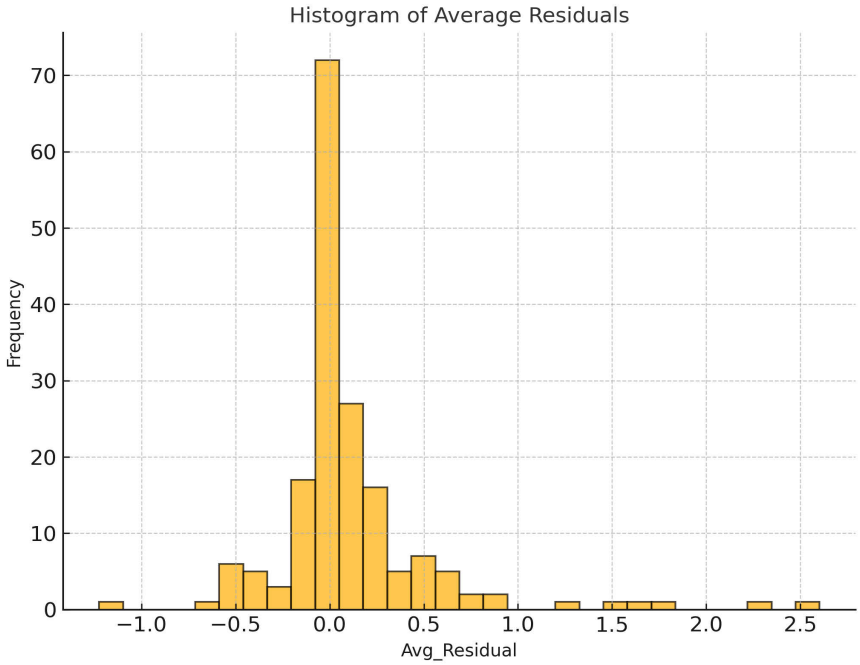
（Negative R^2 values have been adjusted to 0.）

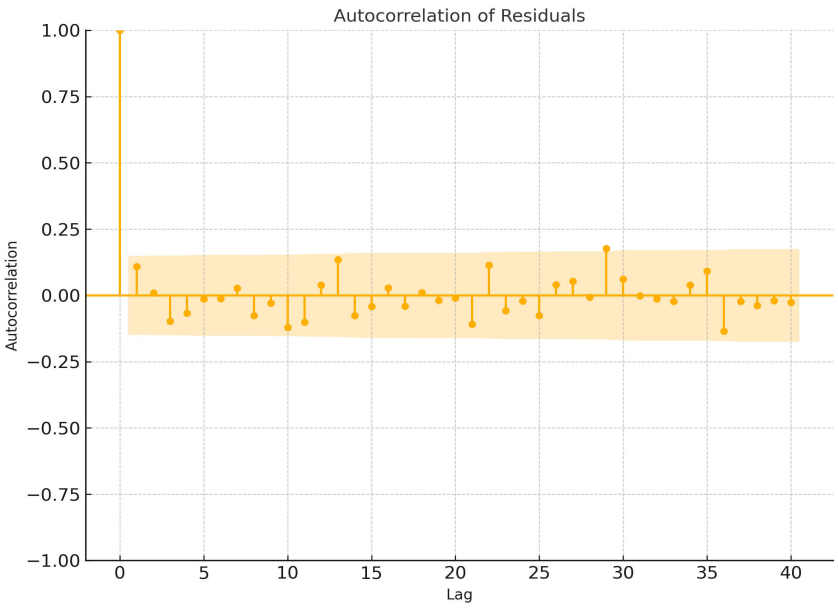




Summary of Residuals for All Observations

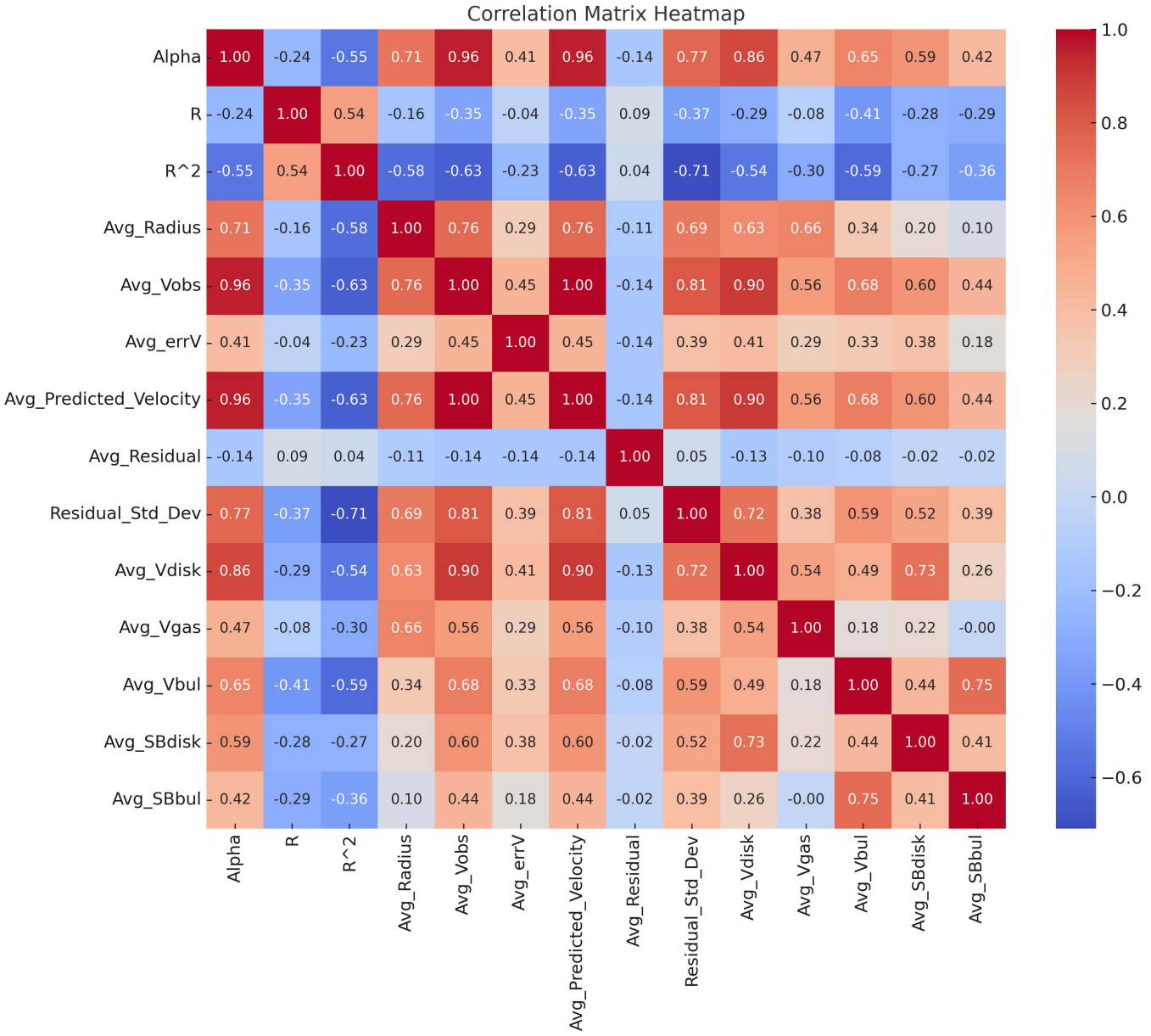
Metric	Value
Overall Average Residual	0.110
Overall Standard Deviation of Residuals	5.58





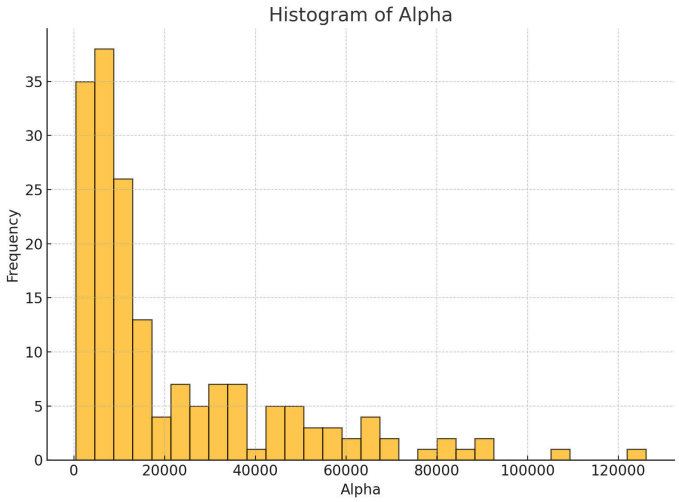
Pearson Correlation Matrix

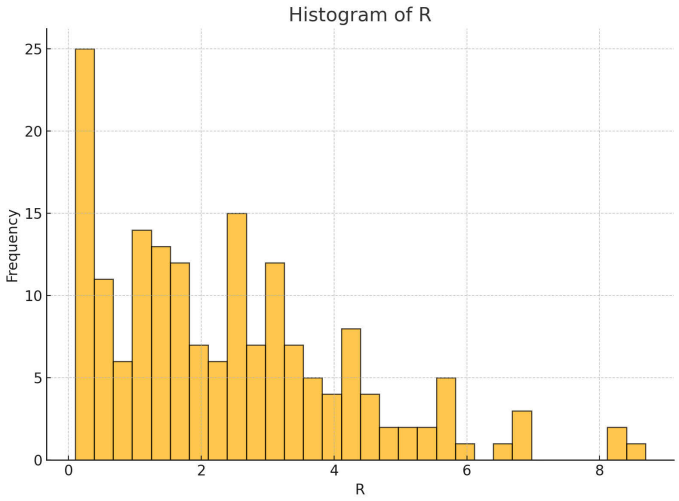
	Alpha	R	R^2	Avg_Radius	Avg_Vobs	Avg_errV	Avg_Predicted_Velocity	Avg_Residual	Residual_Std_Dev	Avg_Vdisk	Avg_Vgas	Avg_Vbul	Avg_SBdisk	Avg_SBbul
Alpha	1	-0.240	-0.548	0.714	0.956	0.411	0.956	-0.137	0.766	0.863	0.469	0.653	0.588	0.419
R	-0.240	1	0.544	-0.157	-0.349	-0.037	-0.349	0.088	-0.366	-0.289	-0.081	-0.408	-0.280	-0.289
R^2	-0.548	0.544	1	-0.579	-0.632	-0.228	-0.632	0.039	-0.709	-0.540	-0.303	-0.591	-0.275	-0.365
Avg_Radius	0.714	-0.157	-0.579	1	0.759	0.293	0.759	-0.109	0.694	0.629	0.665	0.338	0.195	0.095
Avg_Vobs	0.956	-0.349	-0.632	0.759	1	0.450	1.000	-0.138	0.811	0.903	0.564	0.683	0.598	0.443
Avg_errV	0.411	-0.037	-0.228	0.293	0.450	1	0.450	-0.139	0.387	0.412	0.286	0.327	0.377	0.178
Avg_Predicted_Velocity	0.956	-0.349	-0.632	0.759	1.000	0.450	1	-0.144	0.810	0.903	0.564	0.683	0.598	0.443
Avg_Residual	-0.137	0.088	0.039	-0.109	-0.138	-0.139	-0.144	1	0.054	-0.131	-0.099	-0.080	-0.015	-0.024
Residual_Std_Dev	0.766	-0.366	-0.709	0.694	0.811	0.387	0.810	0.054	1	0.722	0.380	0.595	0.522	0.393
Avg_Vdisk	0.863	-0.289	-0.540	0.629	0.903	0.412	0.903	-0.131	0.722	1	0.545	0.485	0.727	0.263
Avg_Vgas	0.469	-0.081	-0.303	0.665	0.564	0.286	0.564	-0.099	0.380	0.545	1	0.181	0.218	-0.002
Avg_Vbul	0.653	-0.408	-0.591	0.338	0.683	0.327	0.683	-0.080	0.595	0.485	0.181	1	0.438	0.749
Avg_SBdisk	0.588	-0.280	-0.275	0.195	0.598	0.377	0.598	-0.015	0.522	0.727	0.218	0.438	1	0.405
Avg_SBbul	0.419	-0.289	-0.365	0.095	0.443	0.178	0.443	-0.024	0.393	0.263	-0.002	0.749	0.405	1

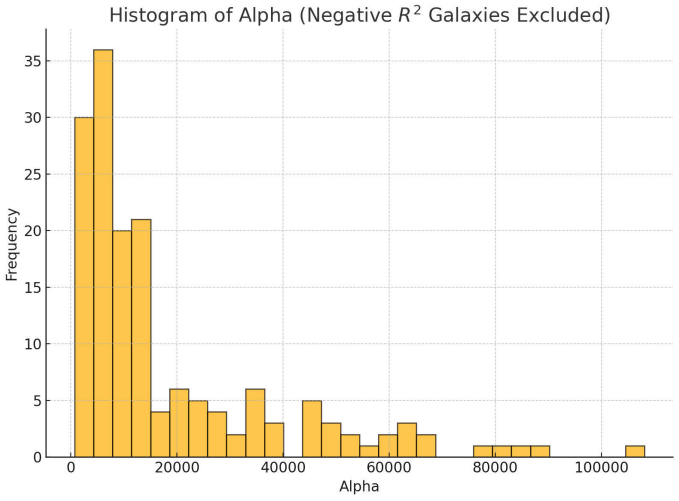


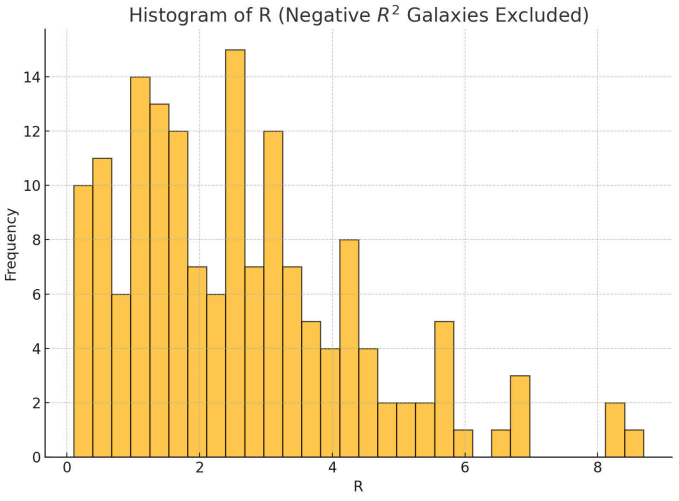
Summary Statistics of Alpha and R (Original and Filtered Dataset)
(Filtered dataset excludes galaxies with negative R^2)

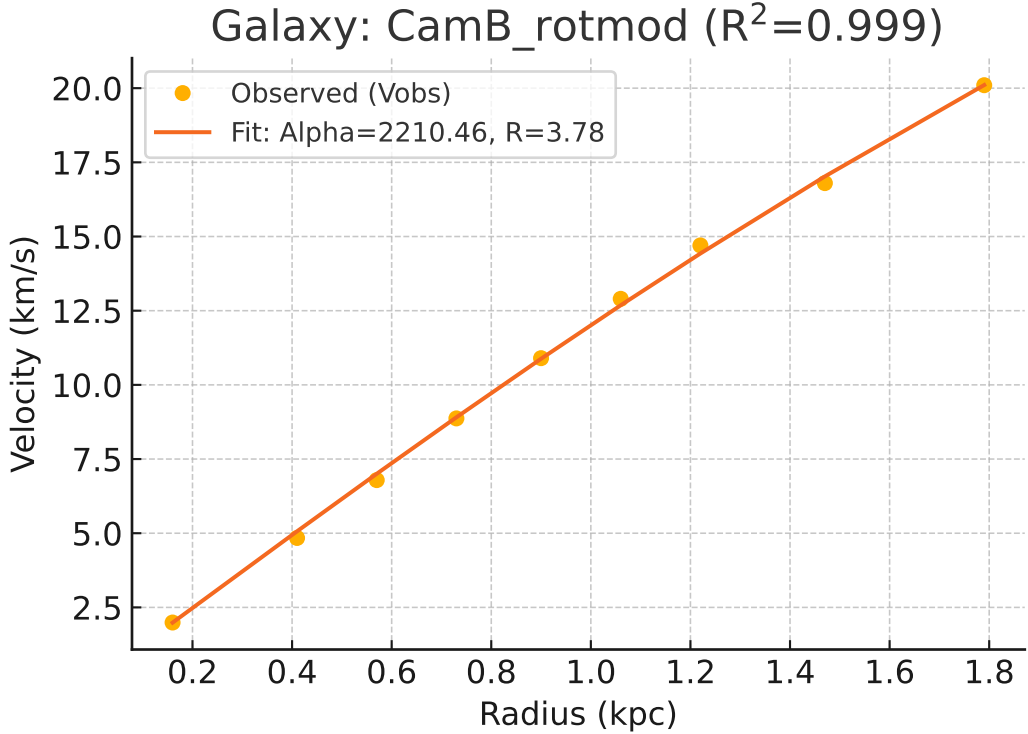
	Count	Mean	Median	Standard Deviation	Min	Max
Alpha	175	21502	11458	23706	373	126070
R	175	2.38	2.10	1.86	0.100	8.69
Alpha（Filtered Dataset）	160	18570	9663	20741	682	108092
R（Filtered Dataset）	160	2.59	2.42	1.80	0.100	8.69

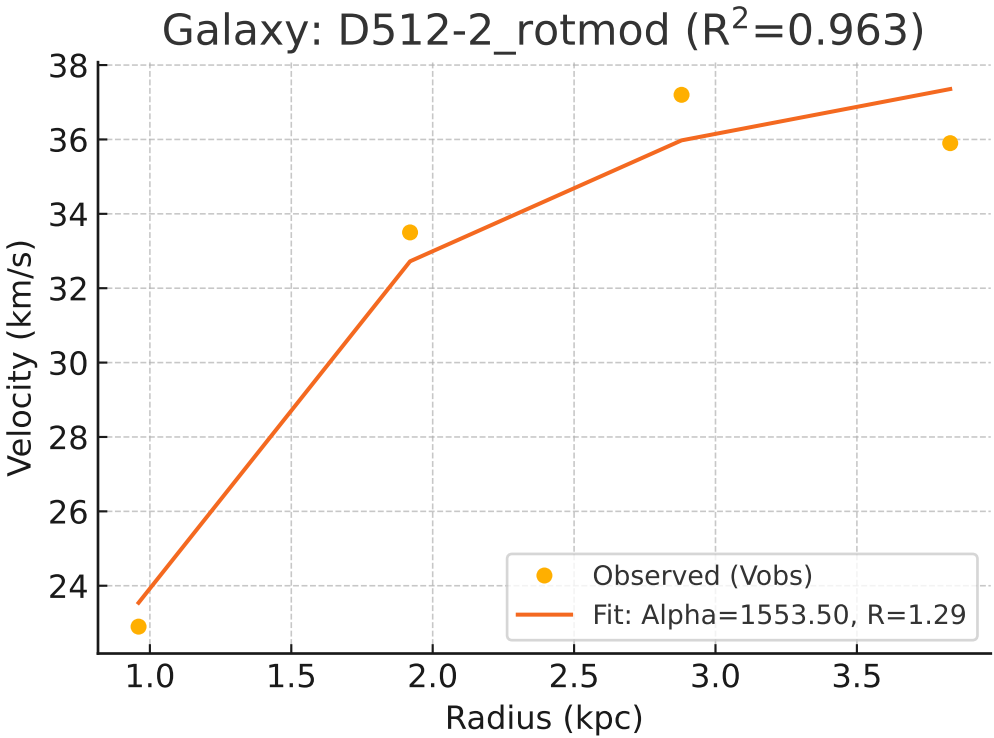


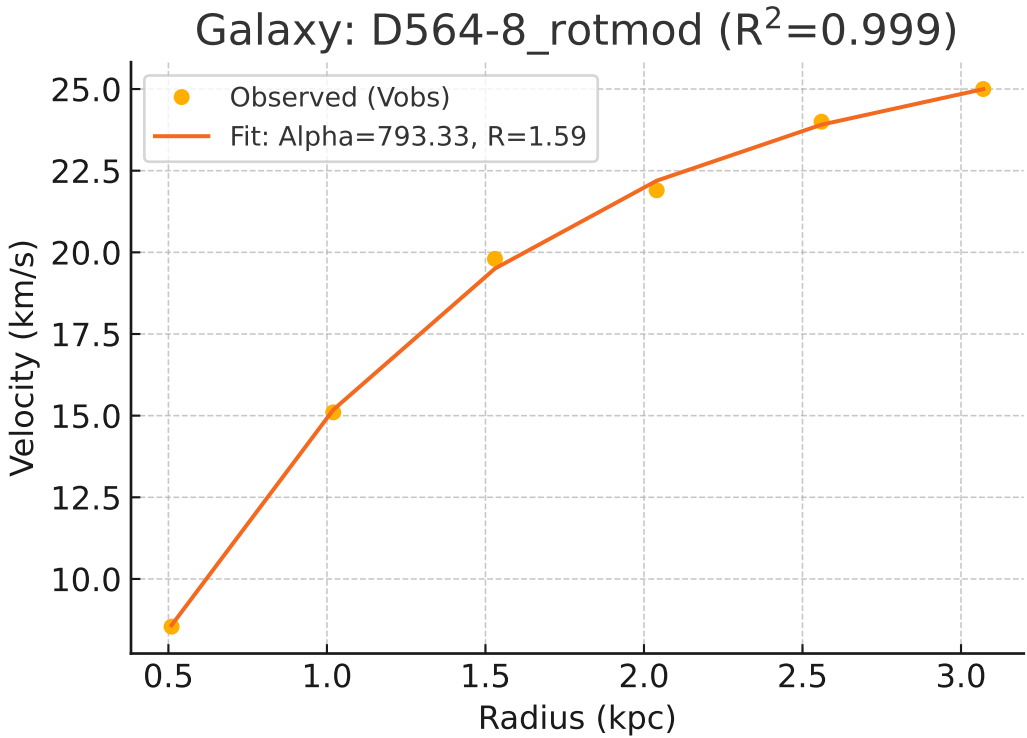


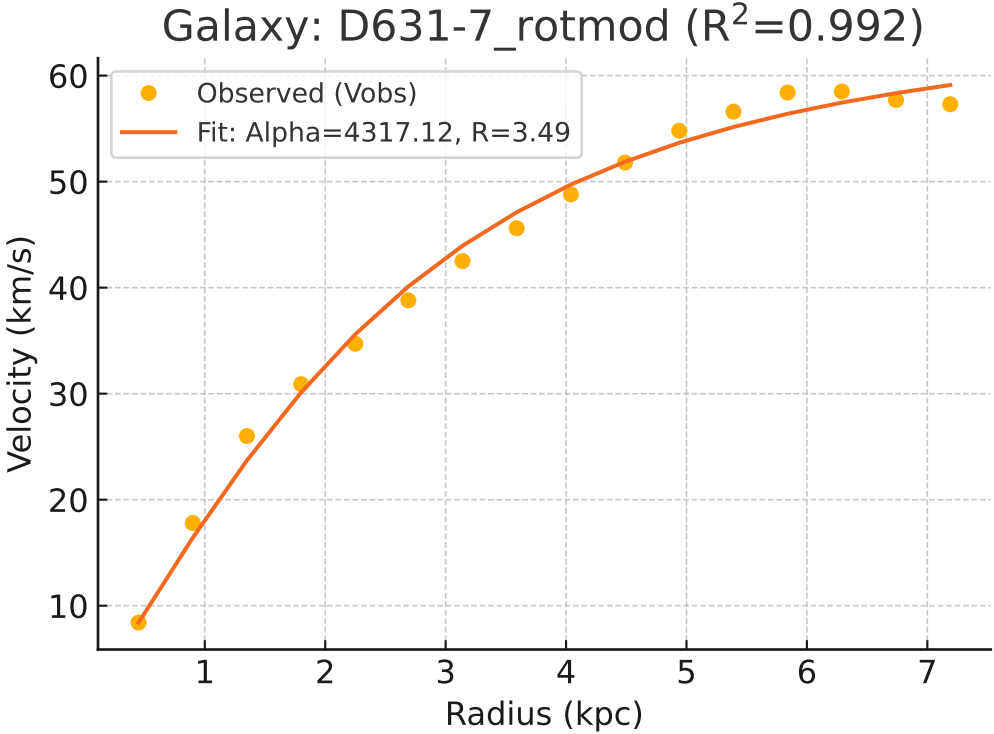


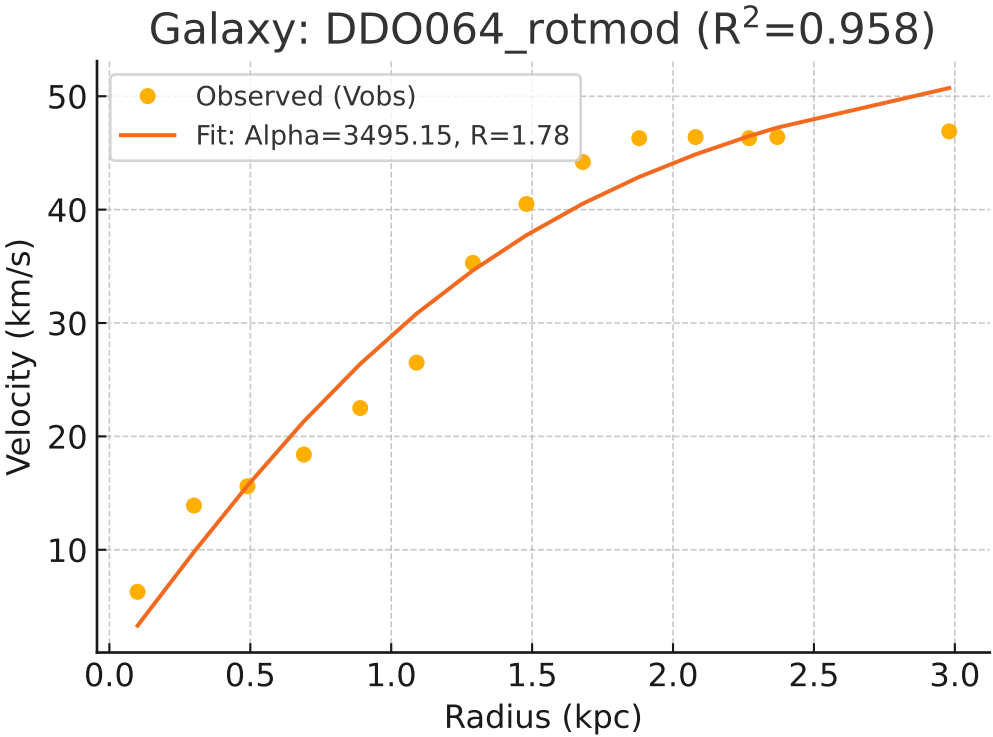


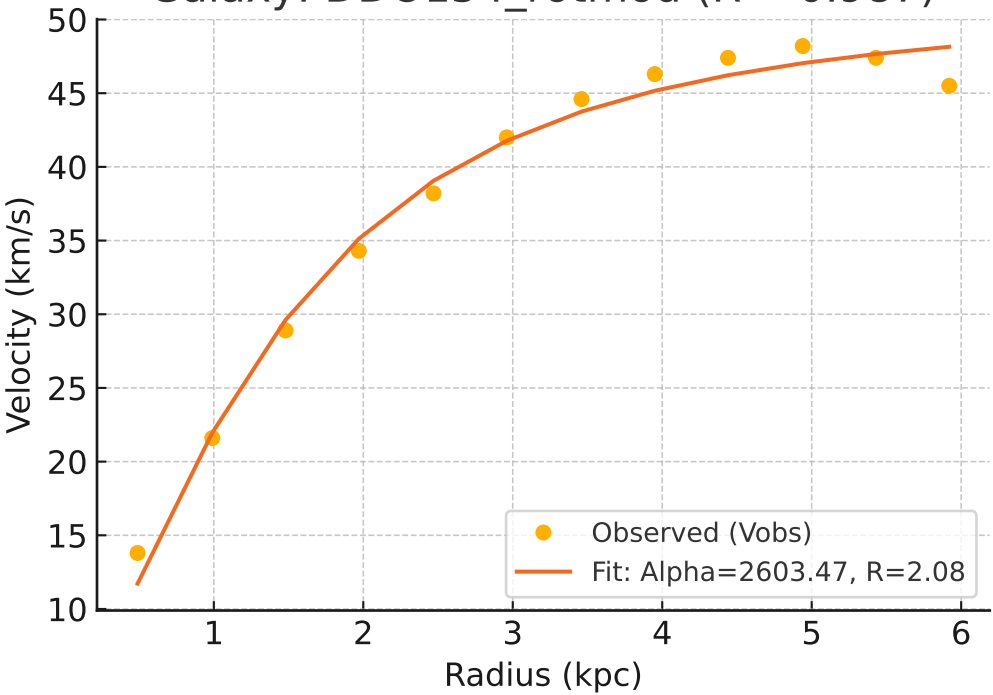

Galaxy: CamB_rotmod (R^2=0.999)
Observed (Vobs)
Fit: Alpha=2210.46, R=3.78
Velocity (km/s)
Radius (kpc)
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8

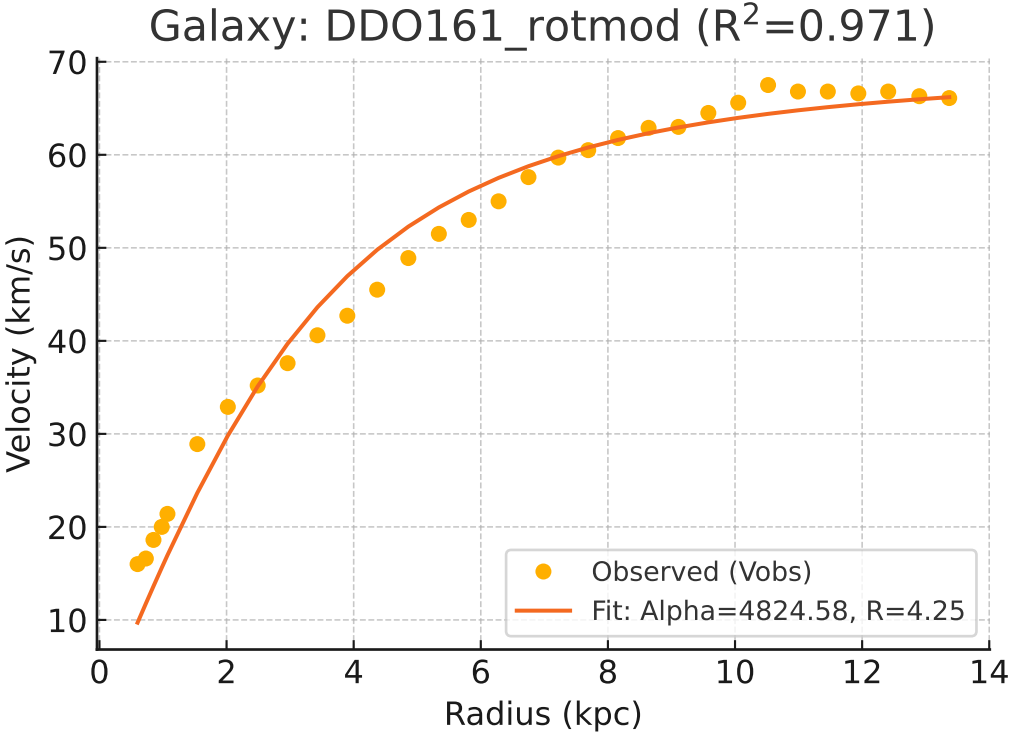

Galaxy: D512-2_rotmod (R^2=0.963)
Velocity (km/s)
Radius (kpc)
38
36
34
32
30
28
26
24
1.0
1.5
2.0
2.5
3.0
3.5
Observed (Vobs)
Fit: Alpha=1553.50, R=1.29

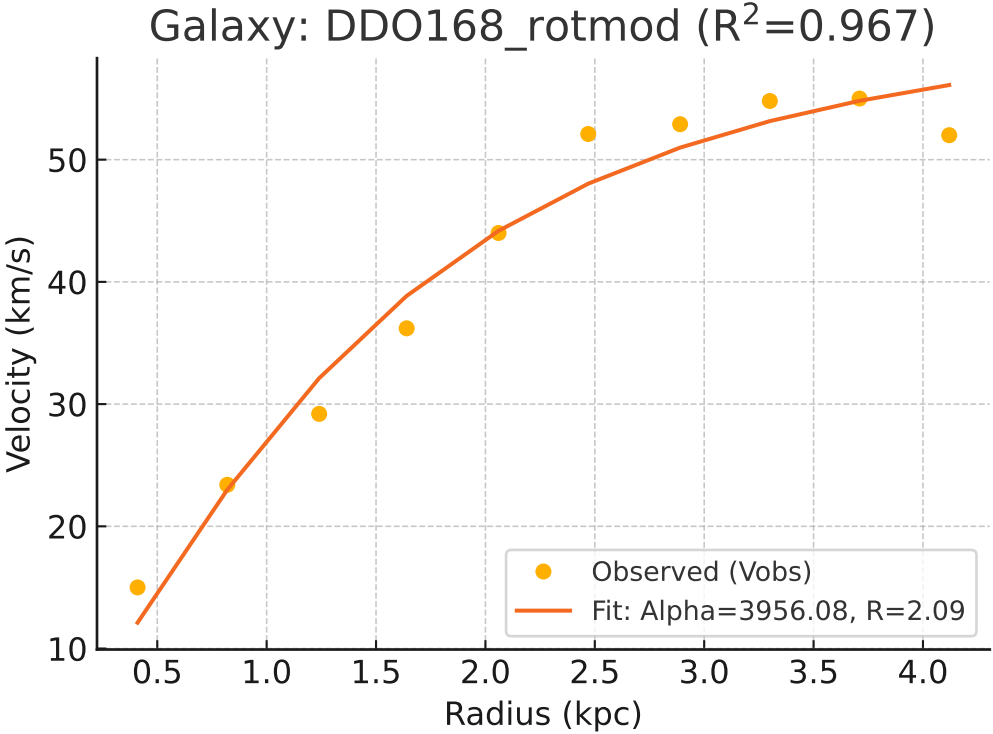

Galaxy: D564-8_rotmod (R^2=0.999)
Observed (Vobs)
Fit: Alpha=793.33, R=1.59
Velocity (km/s)
Radius (kpc)
25.0
22.5
20.0
17.5
15.0
12.5
10.0
0.5
1.0
1.5
2.0
2.5
3.0

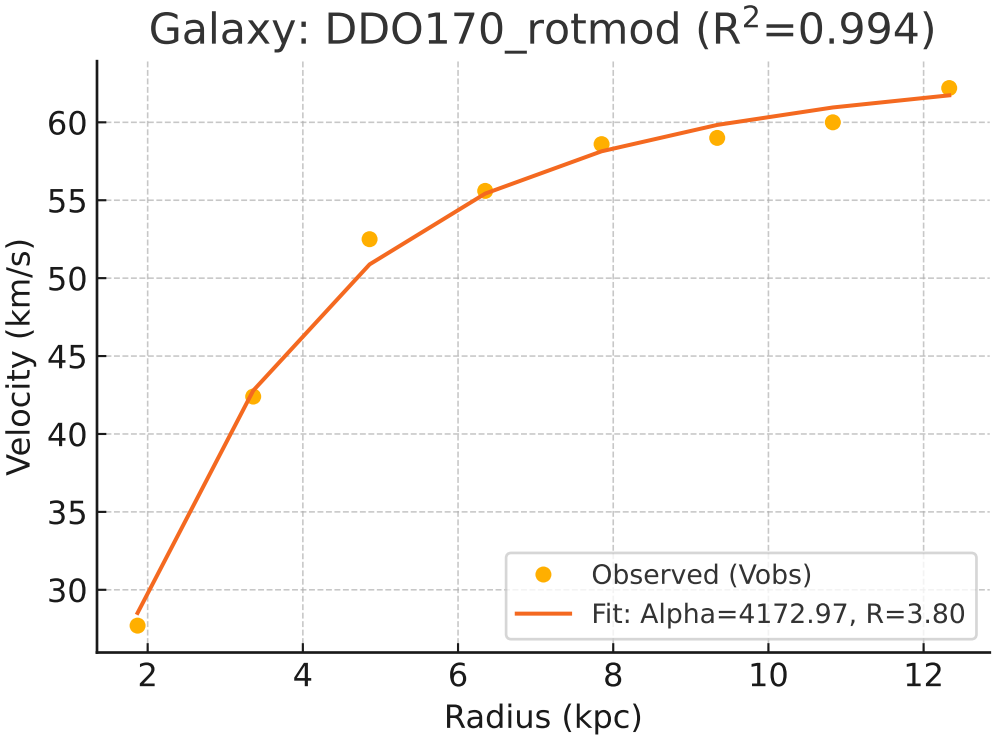

Galaxy: D631-7_rotmod (R^2=0.992)
Observed (Vobs)
Fit: Alpha=4317.12, R=3.49
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
1
2
3
4
5
6
7

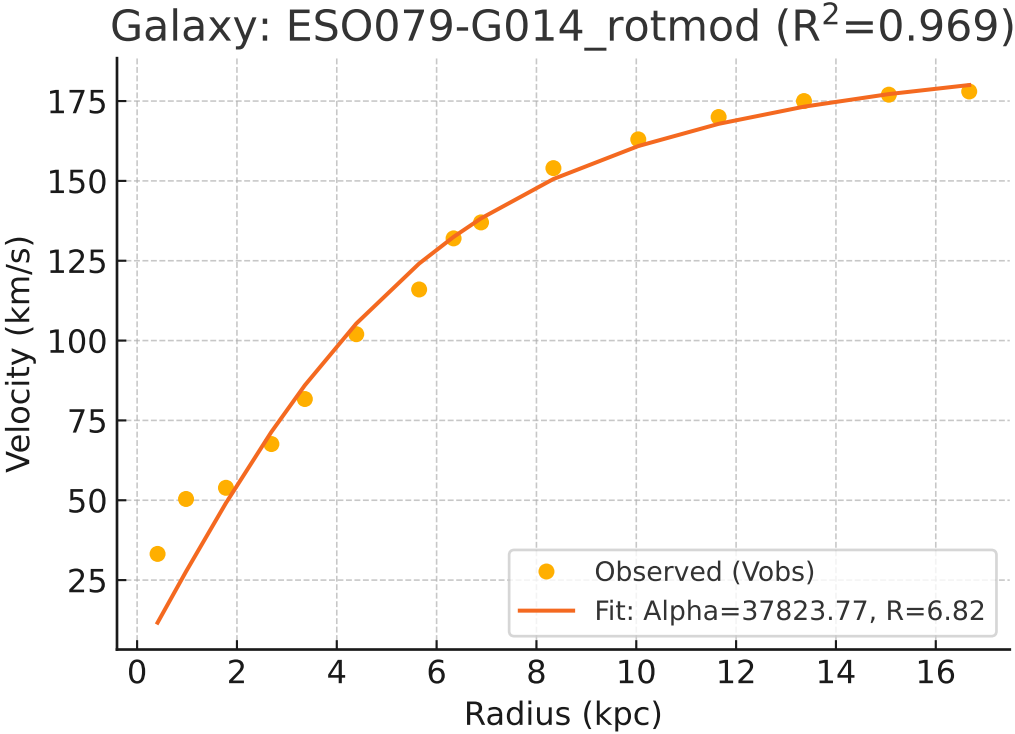

Galaxy: DDO064_rotmod (R^2=0.958)
Observed (Vobs)
Fit: Alpha=3495.15, R=1.78
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
0.0
0.5
1.0
1.5
2.0
2.5
3.0

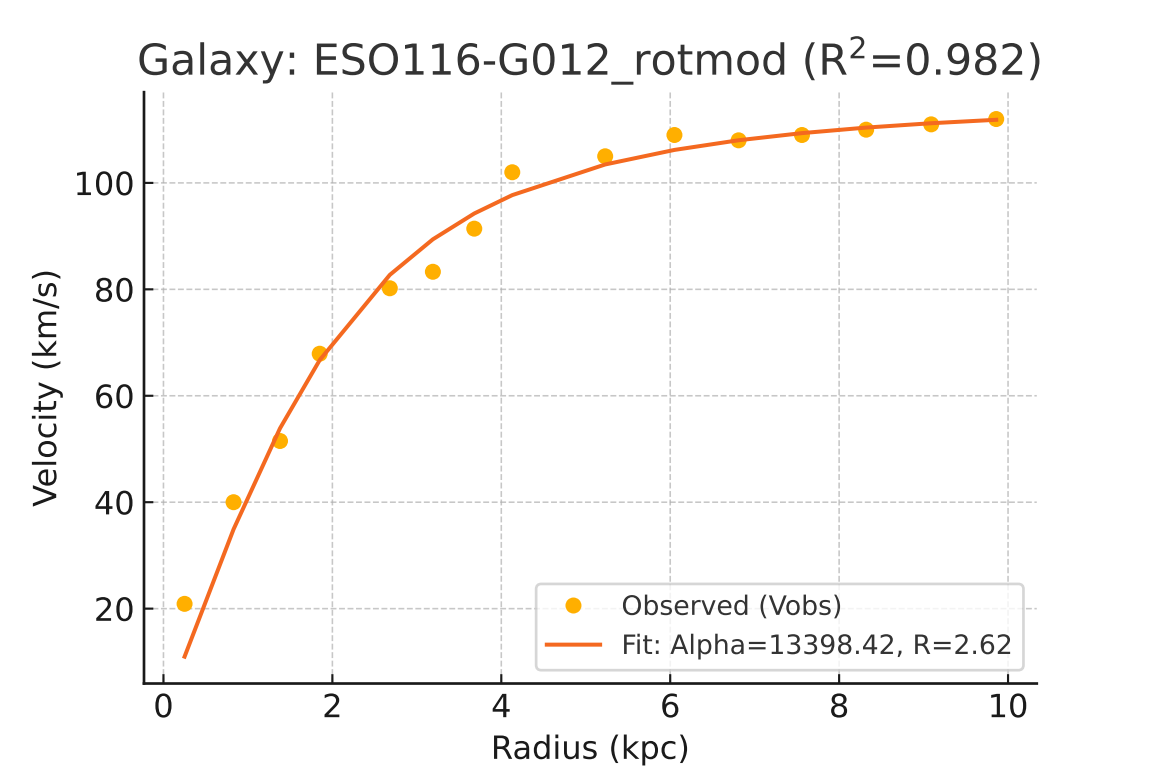

Galaxy: DDO154_rotmod (R^2=0.987)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=2603.47, R=2.08
10
15
20
25
30
35
40
45
50
1
2
3
4
5
6

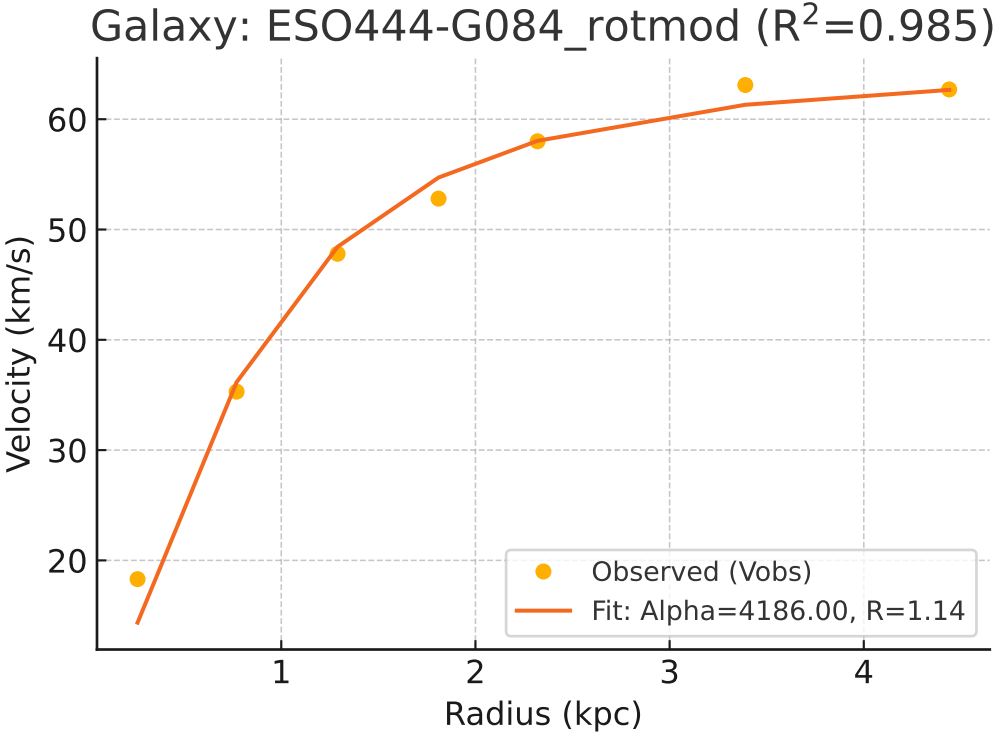

Galaxy: DDO161_rotmod (R^2=0.971)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=4824.58, R=4.25
10
20
30
40
50
60
70
0
2
4
6
8
10
12
14

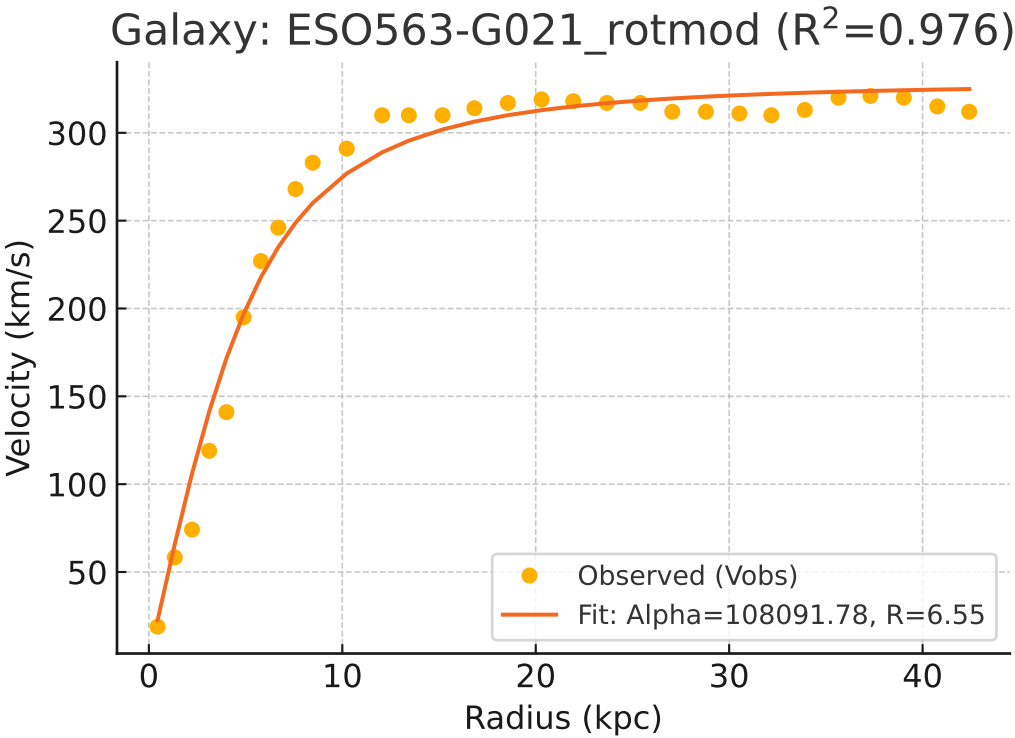

Galaxy: DDO168_rotmod (R^2=0.967)
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Observed (Vobs)
Fit: Alpha=3956.08, R=2.09

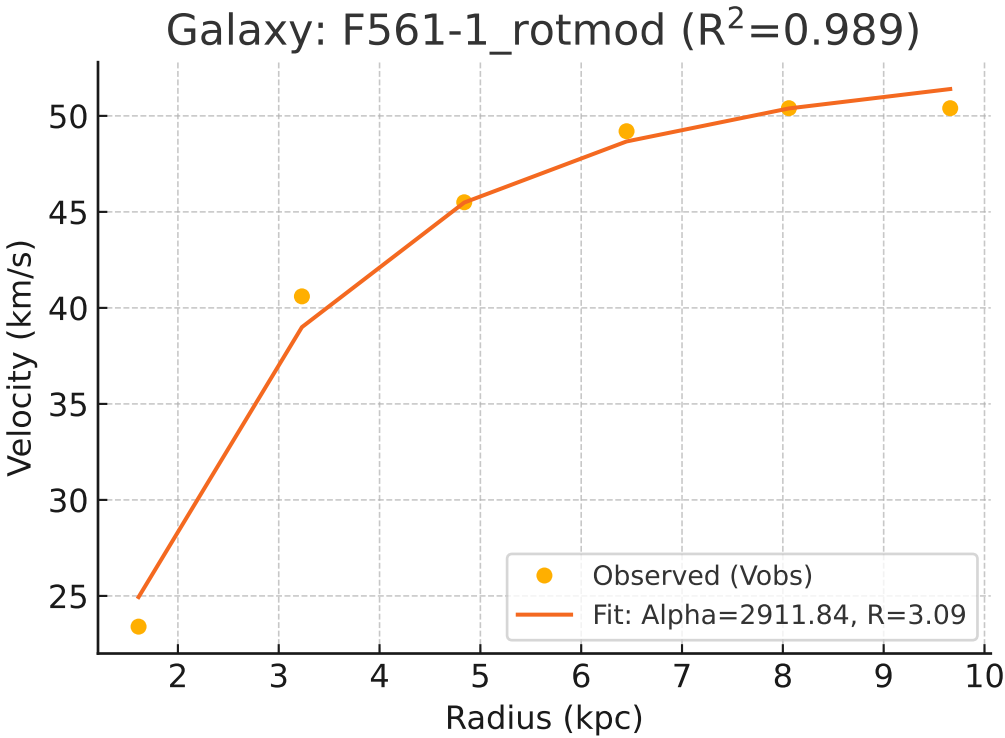

Galaxy: DDO170_rotmod (R^2=0.994)
Velocity (km/s)
Radius (kpc)
30
35
40
45
50
55
60
2
4
6
8
10
12
Observed (Vobs)
Fit: Alpha=4172.97, R=3.80

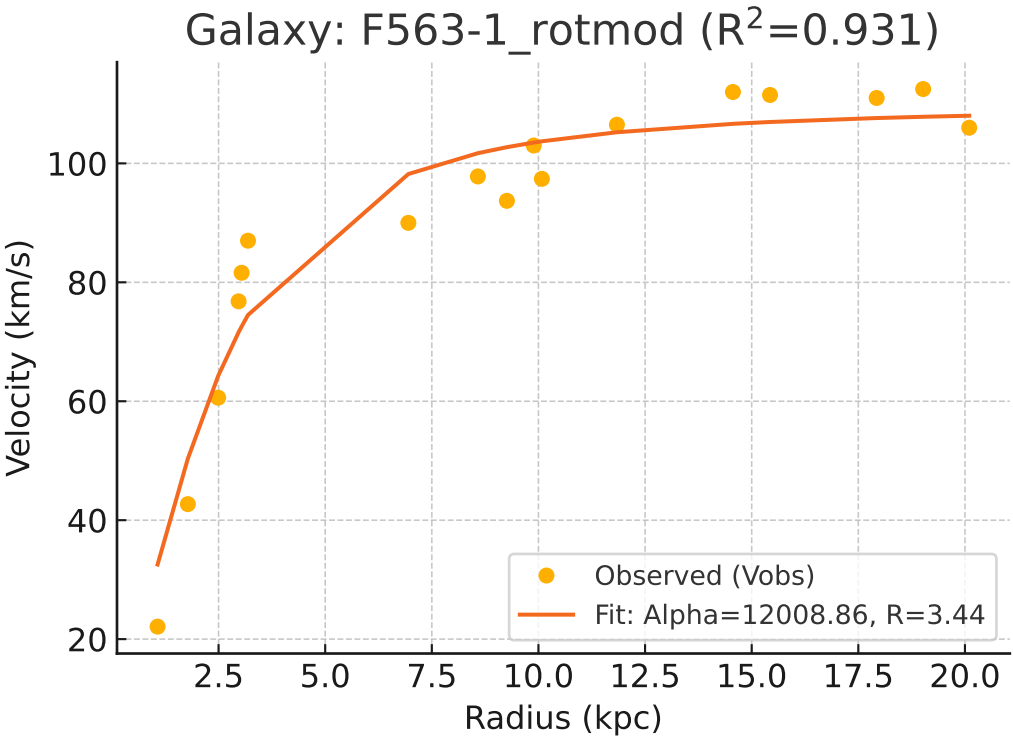

Galaxy: ESO079-G014_rotmod (R^2=0.969)
Velocity (km/s)
Radius (kpc)
25
50
75
100
125
150
175
0
2
4
6
8
10
12
14
16
Observed (Vobs)
Fit: Alpha=37823.77, R=6.82

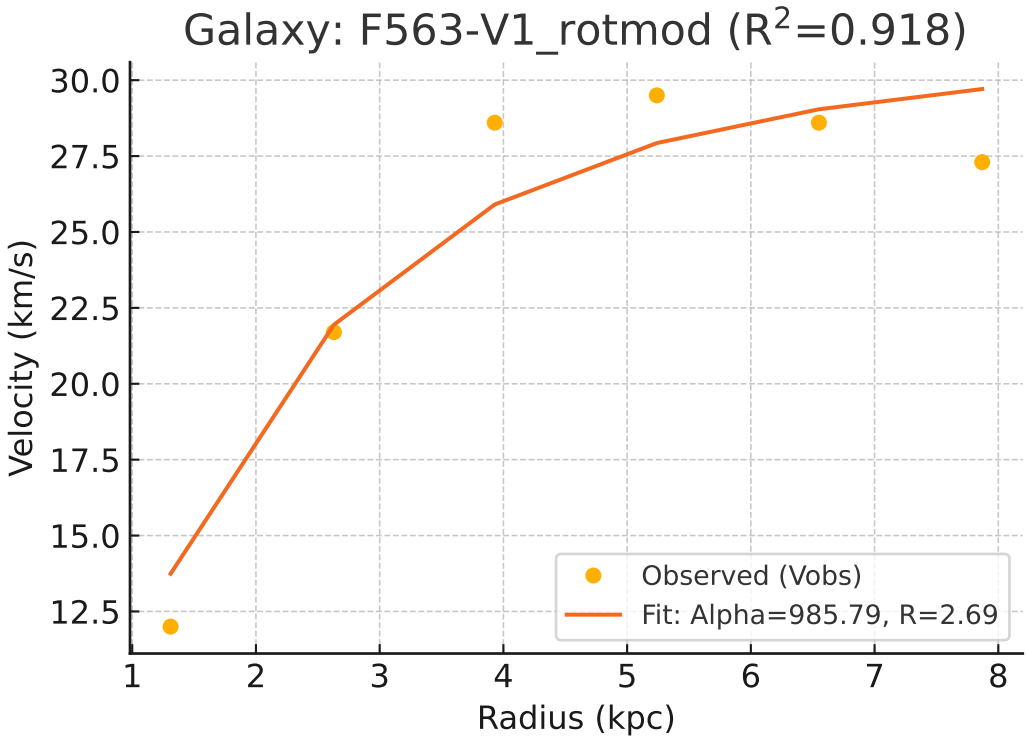

Galaxy: ESO116-G012_rotmod (R^2=0.982)
Velocity (km/s)
Radius (kpc)
20
40
60
80
100
0
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=13398.42, R=2.62

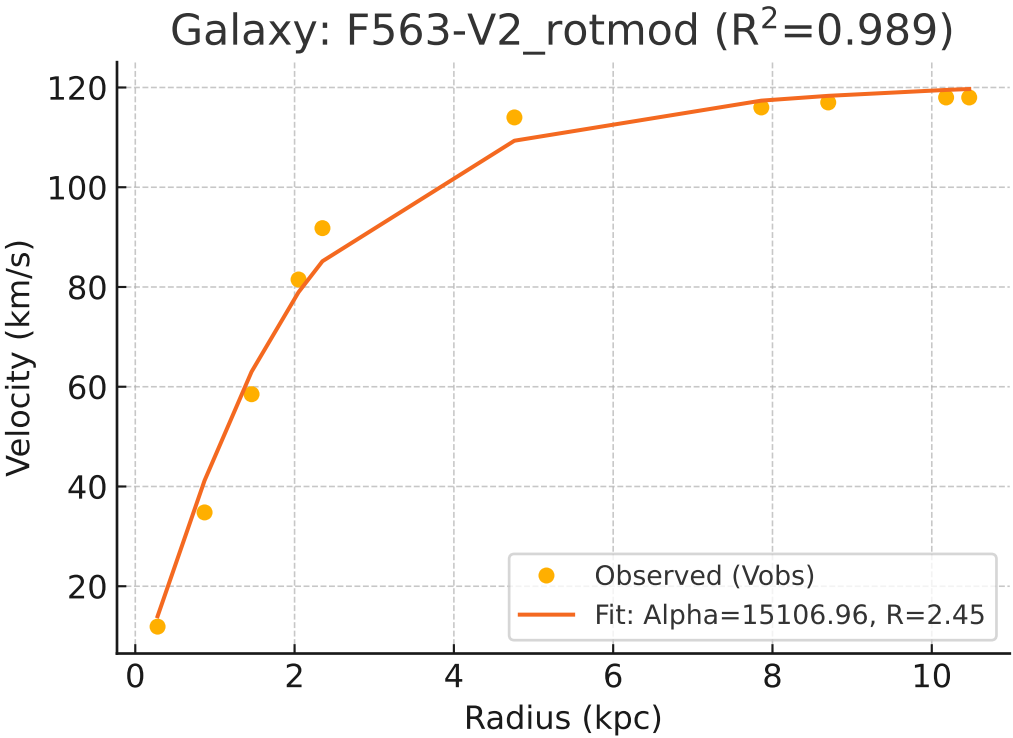

Galaxy: ESO444-G084_rotmod (R^2=0.985)
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
1
2
3
4
Observed (Vobs)
Fit: Alpha=4186.00, R=1.14

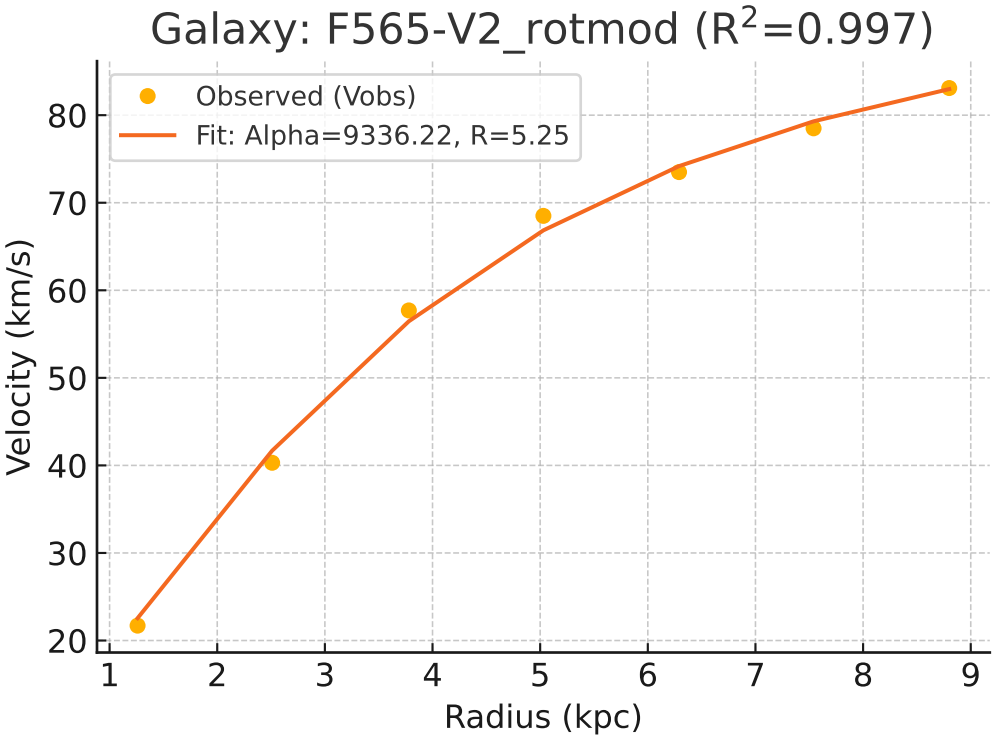

Galaxy: ESO563-G021_rotmod (R^2=0.976)
Velocity (km/s)
Radius (kpc)
300
250
200
150
100
50
0
10
20
30
40
Observed (Vobs)
Fit: Alpha=108091.78, R=6.55

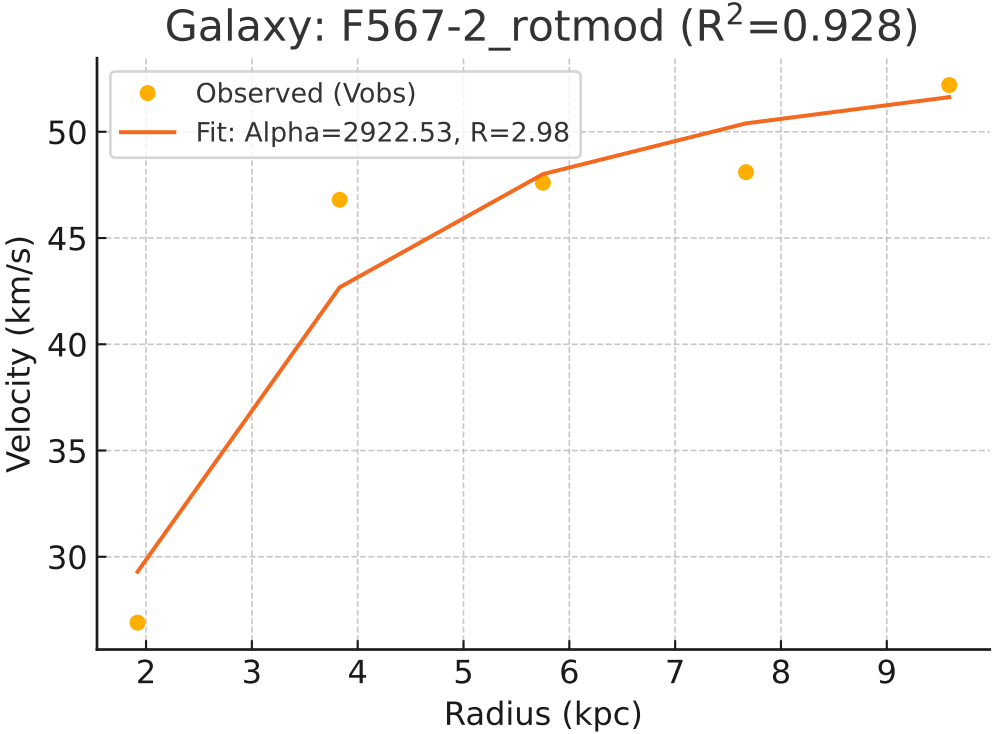

Galaxy: F561-1_rotmod (R^2=0.989)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=2911.84, R=3.09

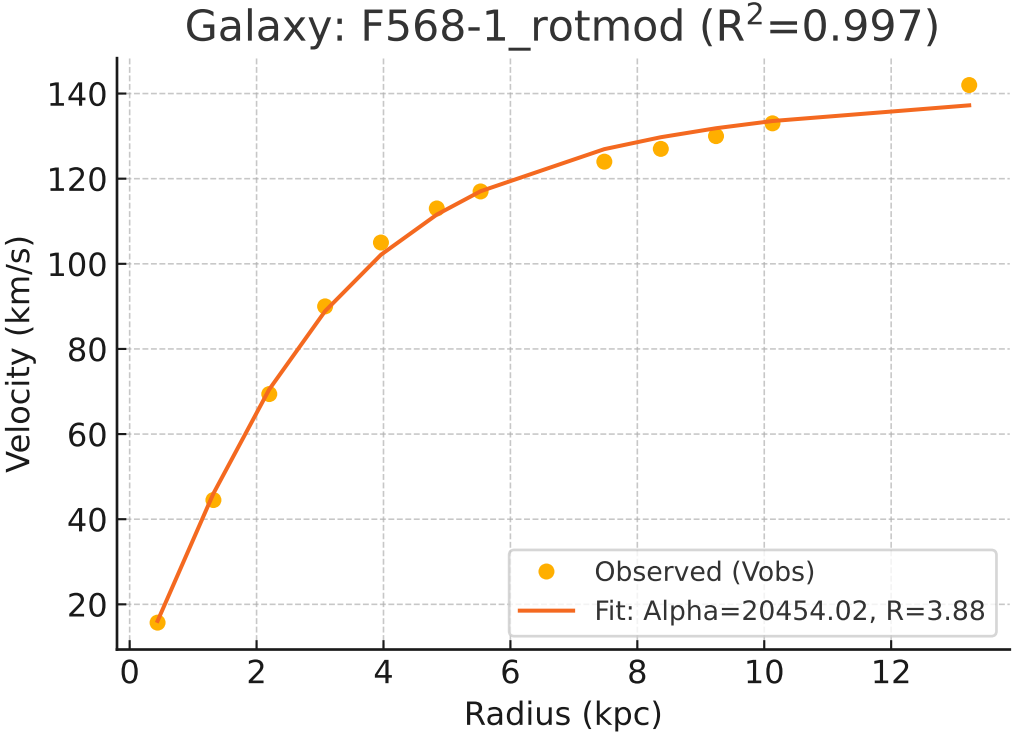

Galaxy: F563-1_rotmod (R^2=0.931)
Velocity (km/s)
Radius (kpc)
20
40
60
80
100
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Observed (Vobs)
Fit: Alpha=12008.86, R=3.44

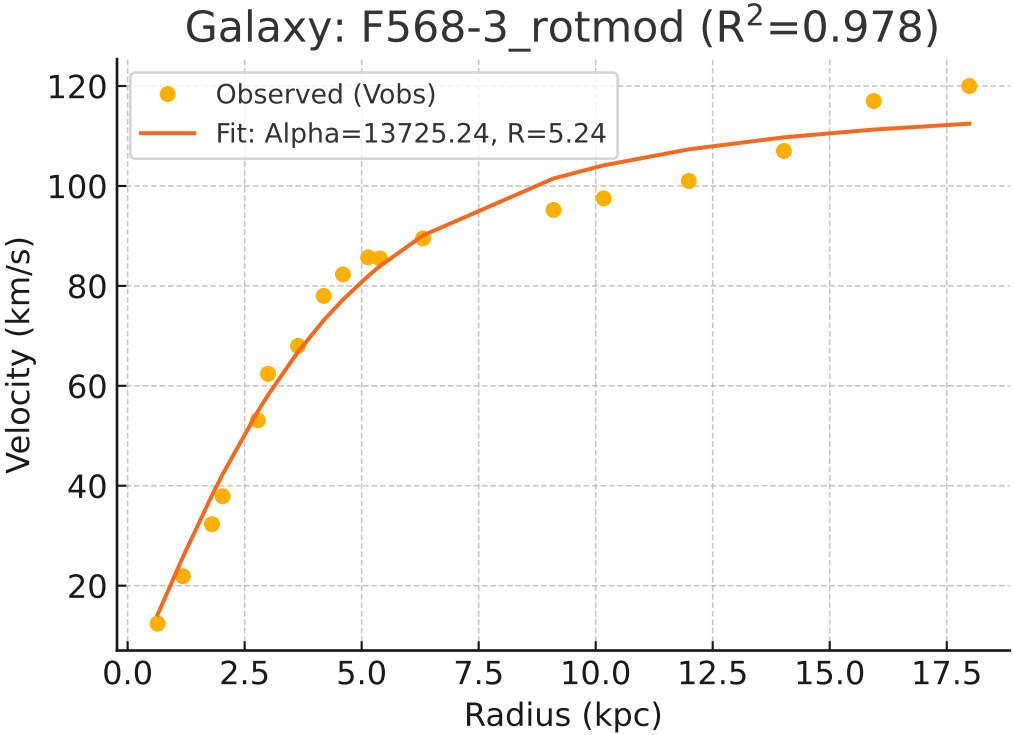

Galaxy: F563-V1_rotmod (R^2=0.918)
Velocity (km/s)
Radius (kpc)
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=985.79, R=2.69

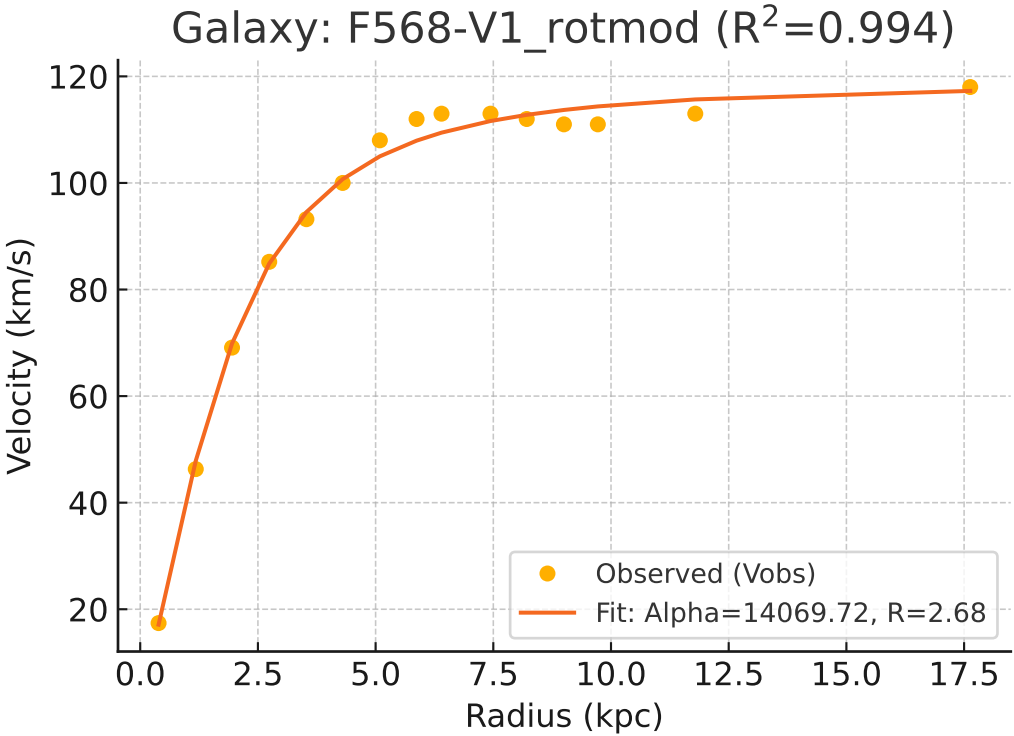

Galaxy: F563-V2_rotmod (R^2=0.989)
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
20
0
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=15106.96, R=2.45

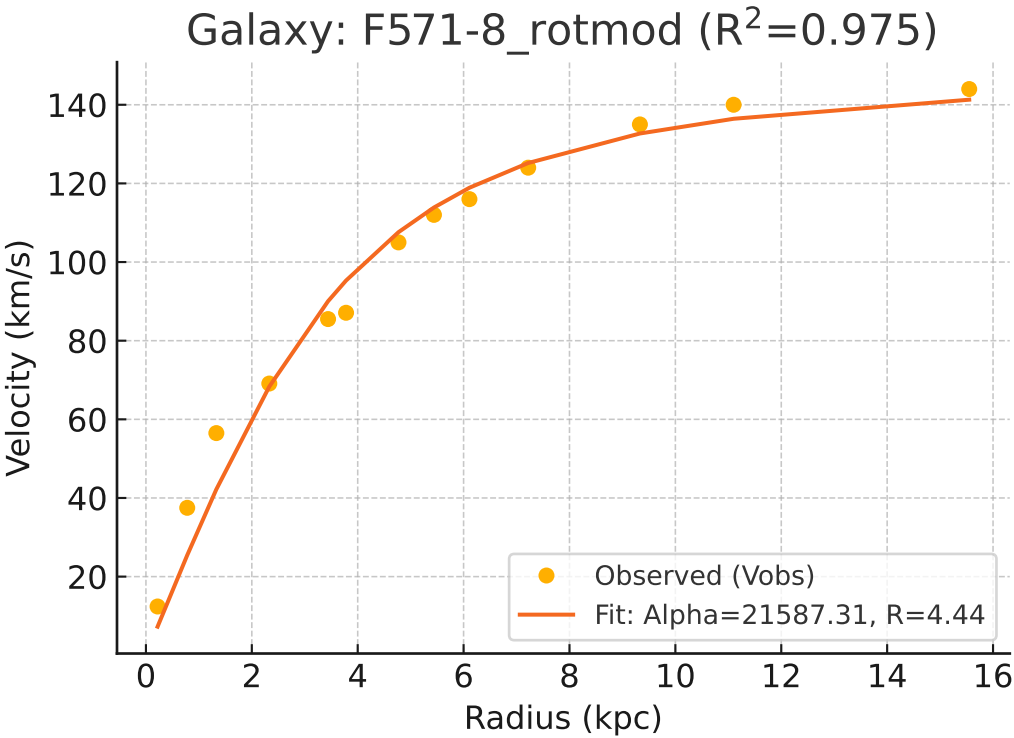

Galaxy: F565-V2_rotmod (R^2=0.997)
Observed (Vobs)
Fit: Alpha=9336.22, R=5.25
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
70
80
1
2
3
4
5
6
7
8
9

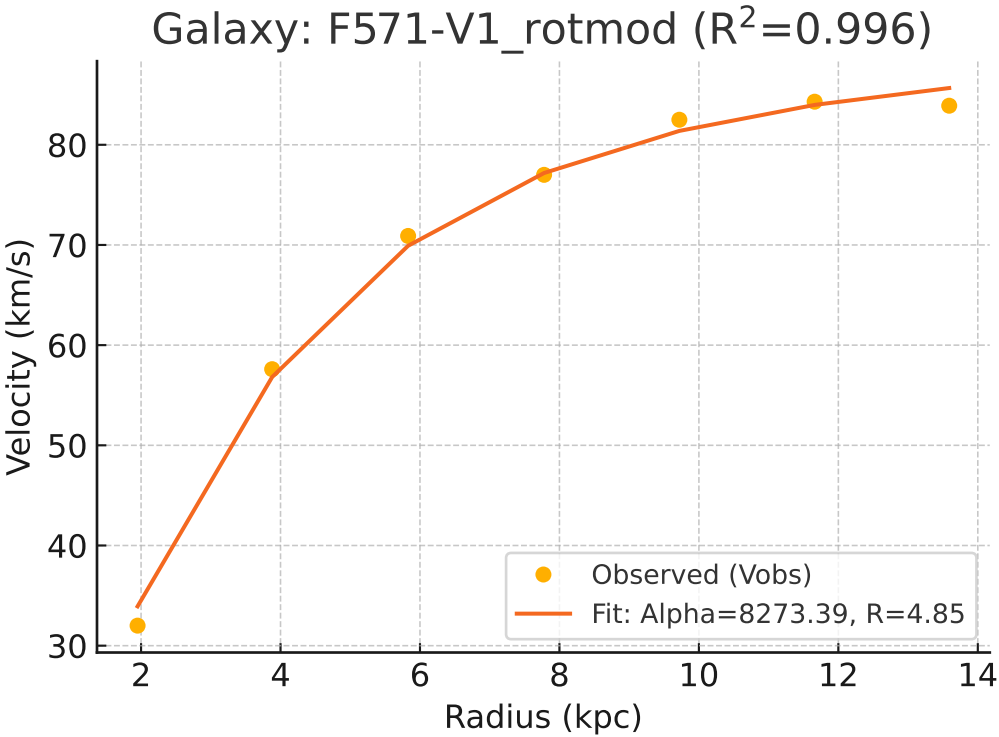

Galaxy: F567-2_rotmod (R^2=0.928)
Observed (Vobs)
Fit: Alpha=2922.53, R=2.98
Velocity (km/s)
Radius (kpc)
30
35
40
45
50
2
3
4
5
6
7
8
9

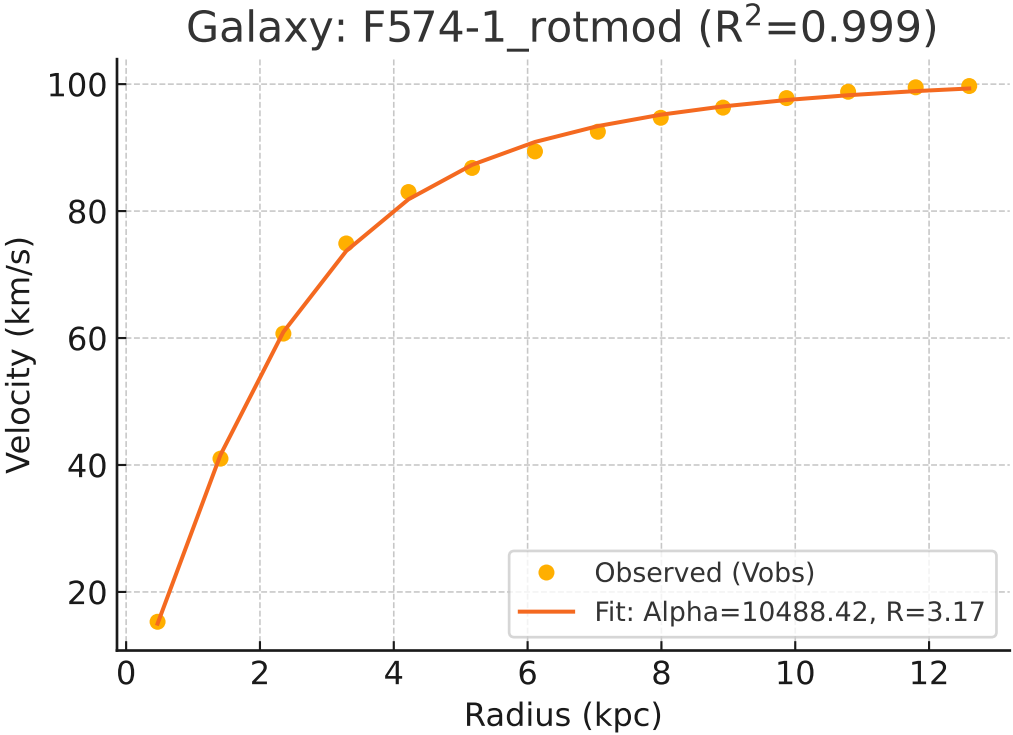

Galaxy: F568-1_rotmod (R^2=0.997)
Velocity (km/s)
Radius (kpc)
140
120
100
80
60
40
20
0
2
4
6
8
10
12
Observed (Vobs)
Fit: Alpha=20454.02, R=3.88

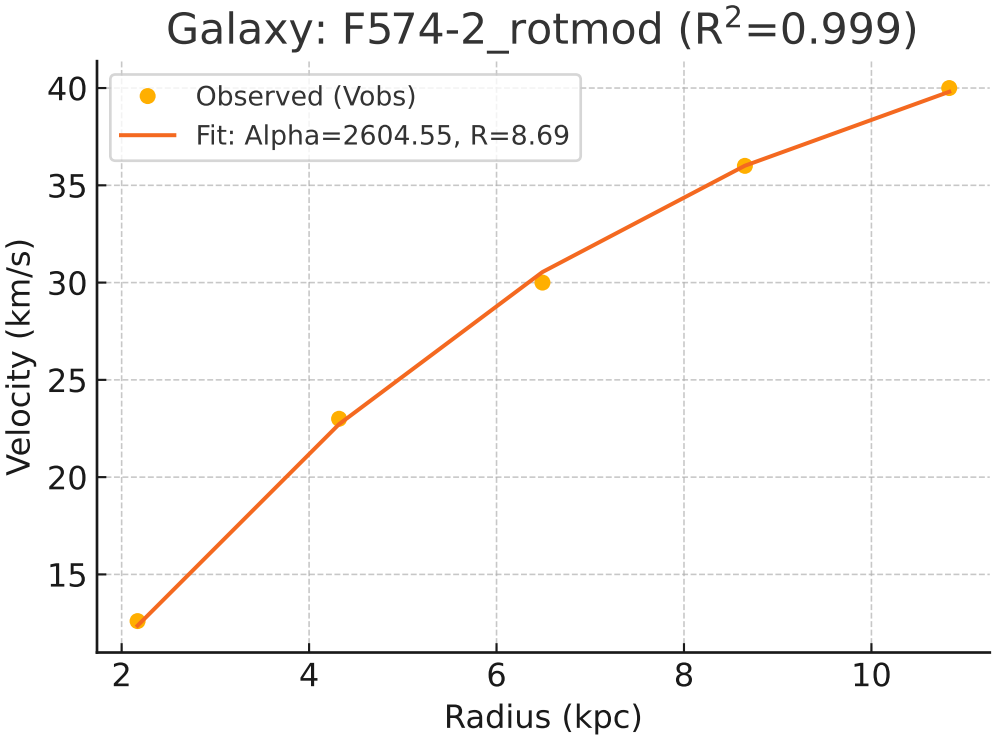

Galaxy: F568-3_rotmod (R^2=0.978)
Observed (Vobs)
Fit: Alpha=13725.24, R=5.24
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
20
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5

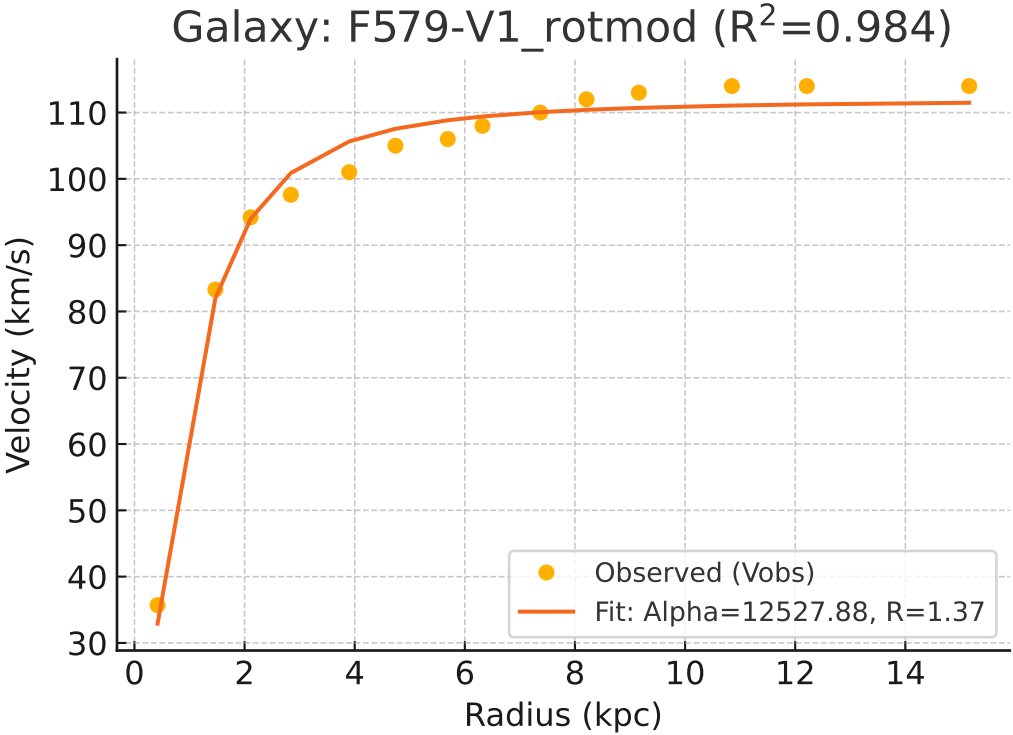

Galaxy: F568-V1_rotmod (R^2=0.994)
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
20
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
Observed (Vobs)
Fit: Alpha=14069.72, R=2.68

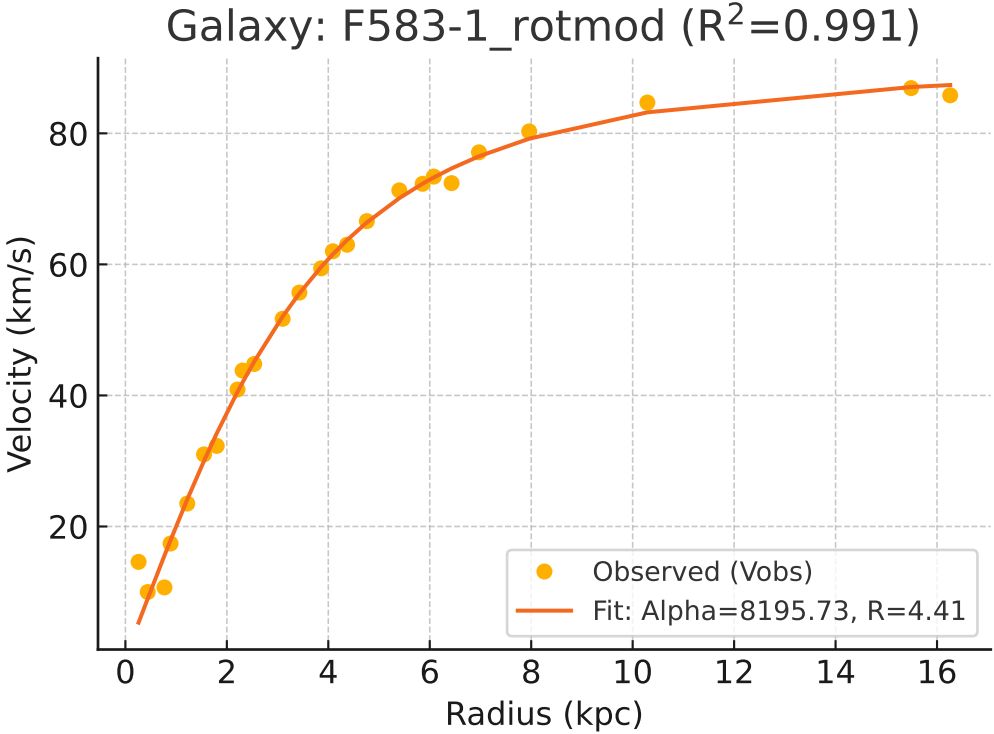

Galaxy: F571-8_rotmod (R^2=0.975)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=21587.31, R=4.44
20
40
60
80
100
120
140
0
2
4
6
8
10
12
14
16

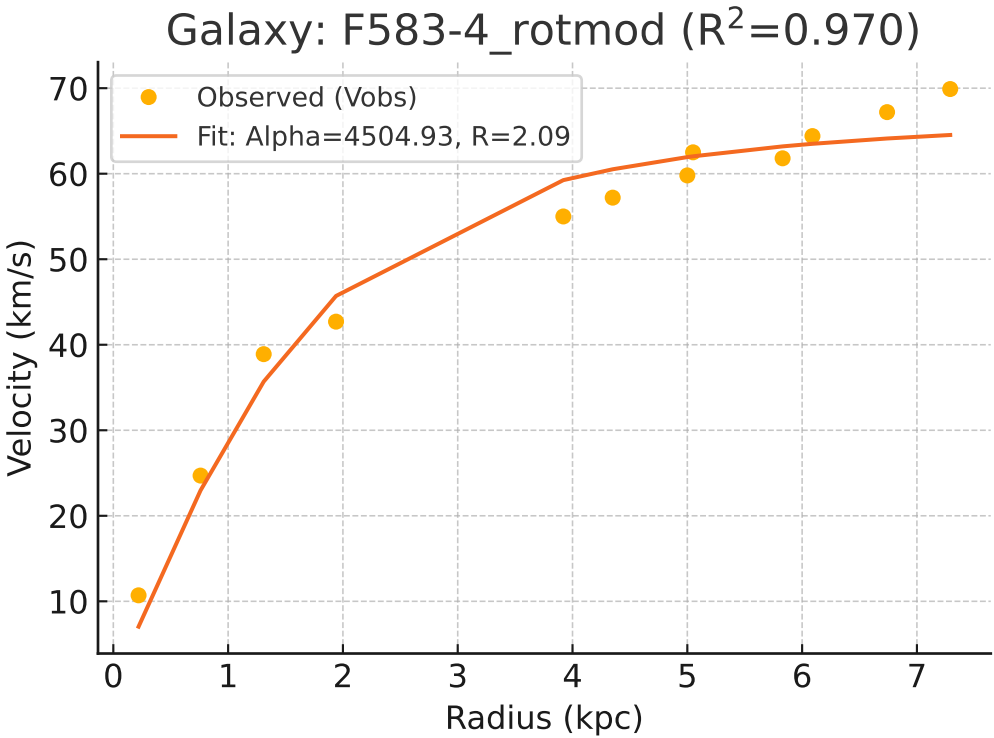

Galaxy: F571-V1_rotmod (R^2=0.996)
Velocity (km/s)
Radius (kpc)
30
40
50
60
70
80
2
4
6
8
10
12
14
Observed (Vobs)
Fit: Alpha=8273.39, R=4.85

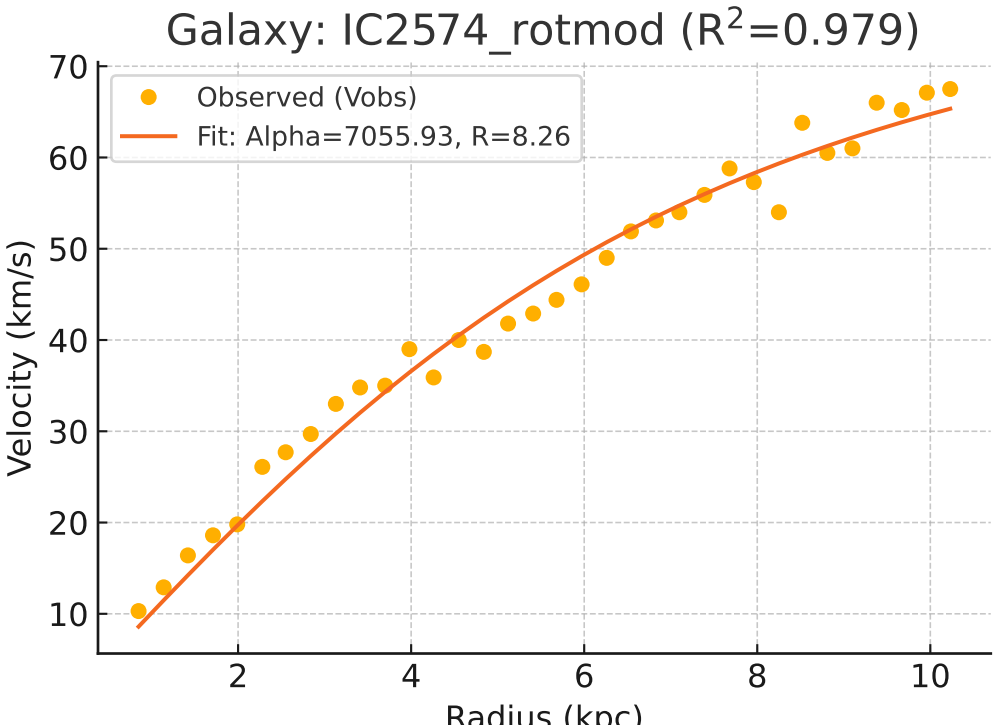

Galaxy: F574-1_rotmod (R^2=0.999)
Velocity (km/s)
Radius (kpc)
100
80
60
40
20
0
2
4
6
8
10
12
Observed (Vobs)
Fit: Alpha=10488.42, R=3.17

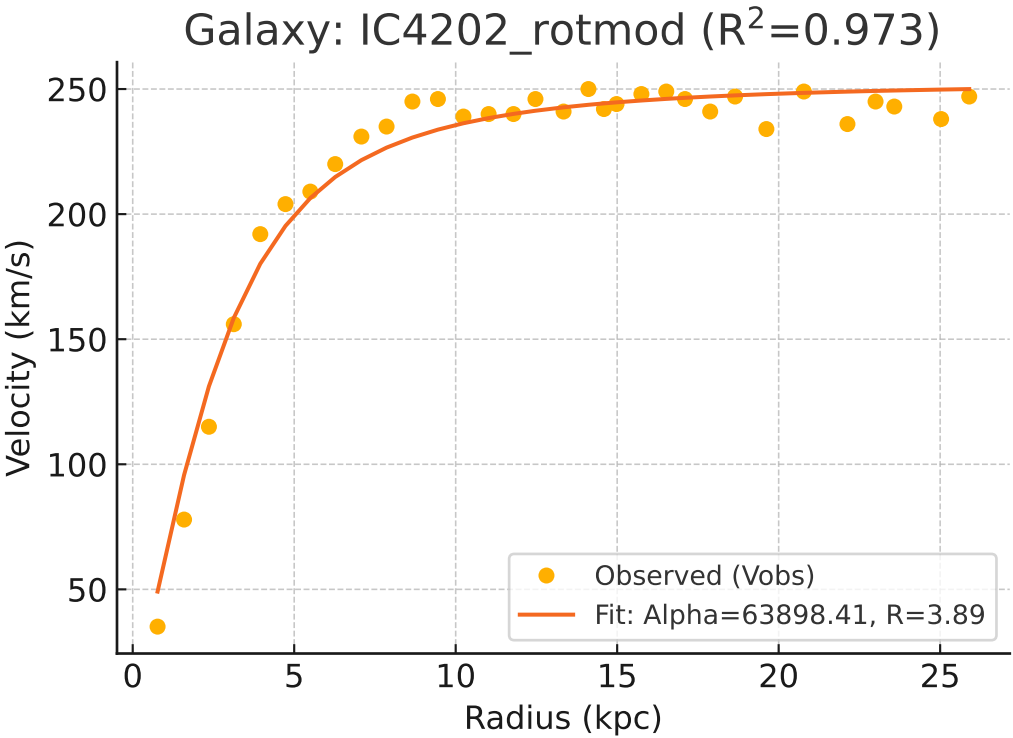

Galaxy: F574-2_rotmod (R^2=0.999)
Observed (Vobs)
Fit: Alpha=2604.55, R=8.69
Velocity (km/s)
Radius (kpc)
40
35
30
25
20
15
2
4
6
8
10

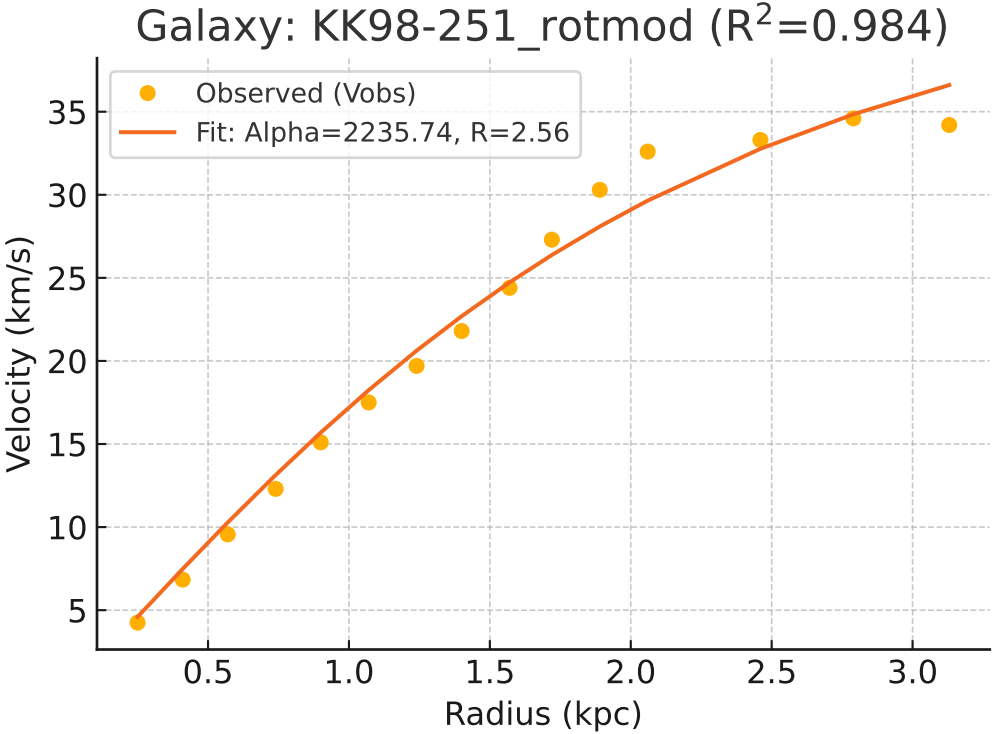

Galaxy: F579-V1_rotmod (R^2=0.984)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=12527.88, R=1.37
30
40
50
60
70
80
90
100
110
0
2
4
6
8
10
12
14

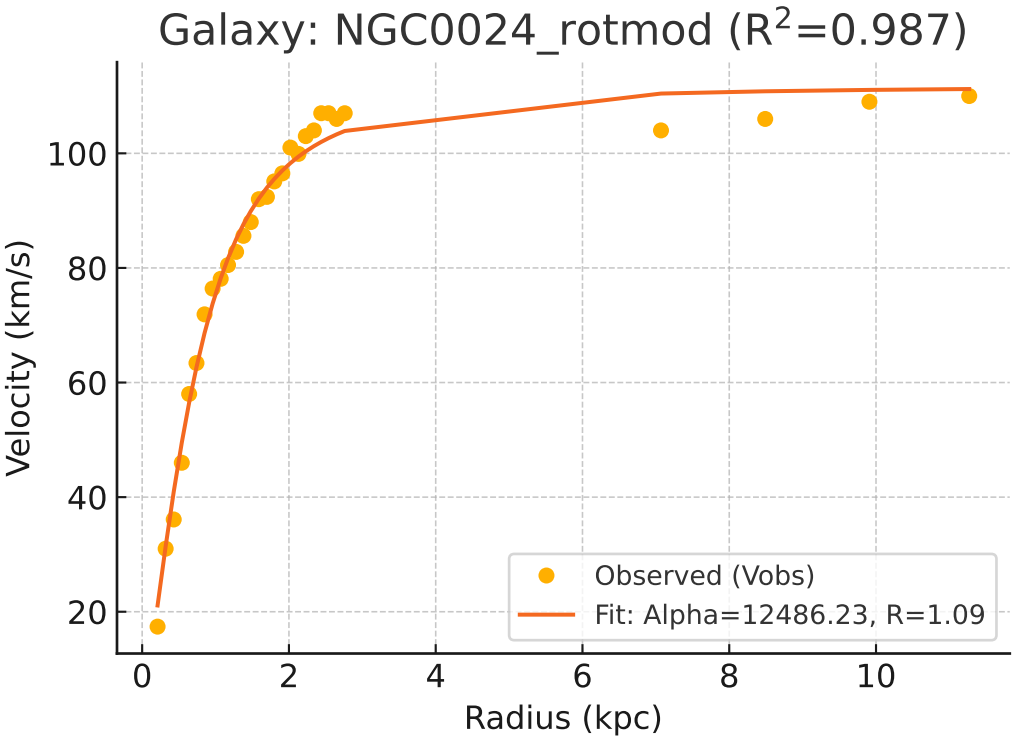

Galaxy: F583-1_rotmod (R^2=0.991)
Velocity (km/s)
Radius (kpc)
20
40
60
80
0
2
4
6
8
10
12
14
16
Observed (Vobs)
Fit: Alpha=8195.73, R=4.41

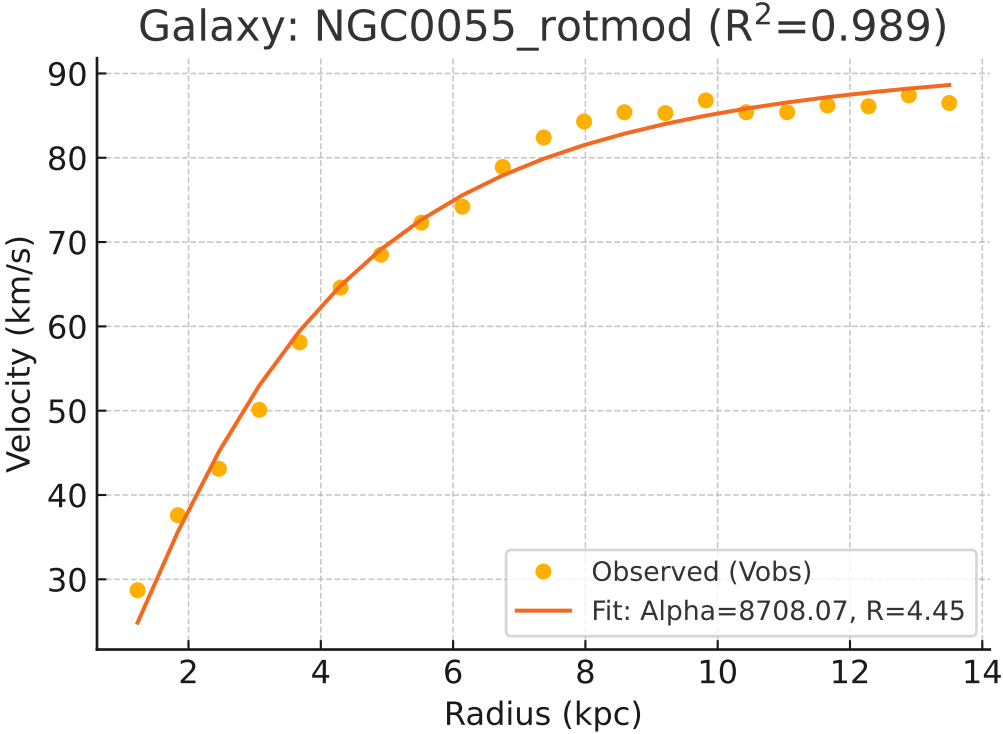

Galaxy: F583-4_rotmod (R^2=0.970)
Observed (Vobs)
Fit: Alpha=4504.93, R=2.09
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
70
0
1
2
3
4
5
6
7

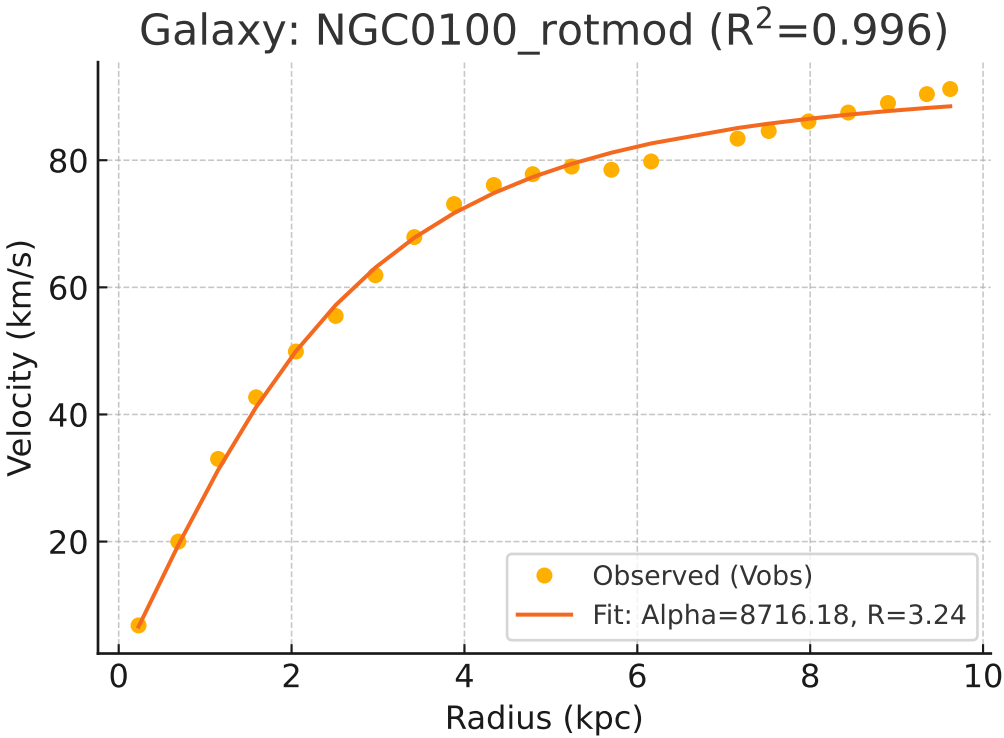

Galaxy: IC2574_rotmod (R^2=0.979)
Observed (Vobs)
Fit: Alpha=7055.93, R=8.26
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
70
2
4
6
8
10

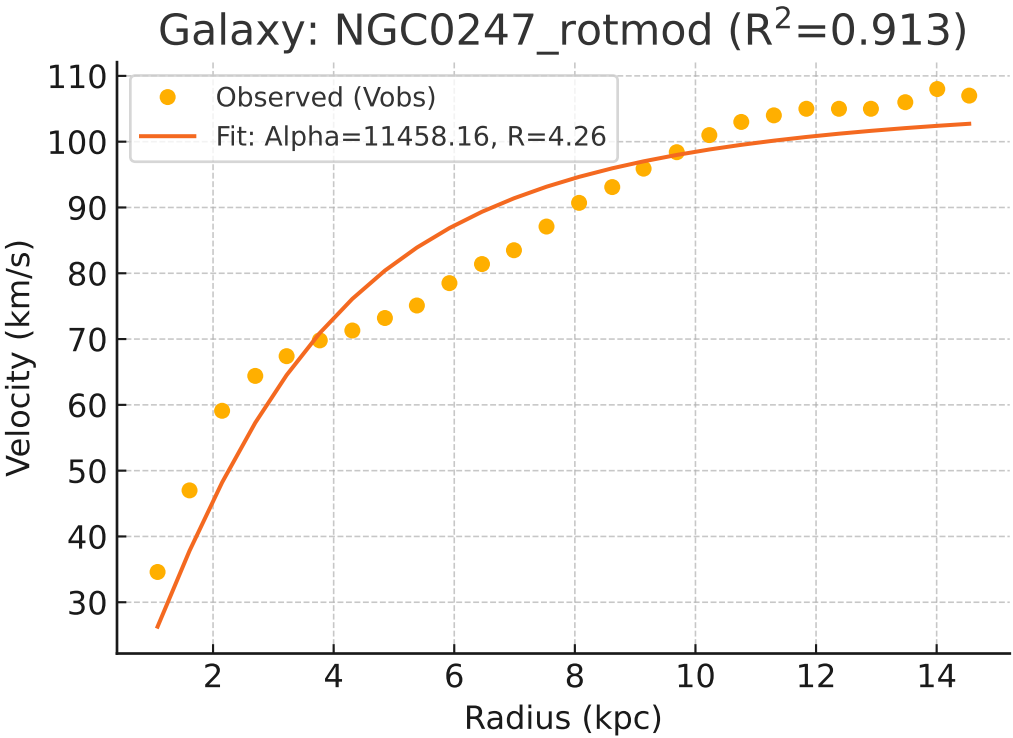

Galaxy: IC4202_rotmod (R^2=0.973)
Velocity (km/s)
Radius (kpc)
250
200
150
100
50
0
5
10
15
20
25
Observed (Vobs)
Fit: Alpha=63898.41, R=3.89

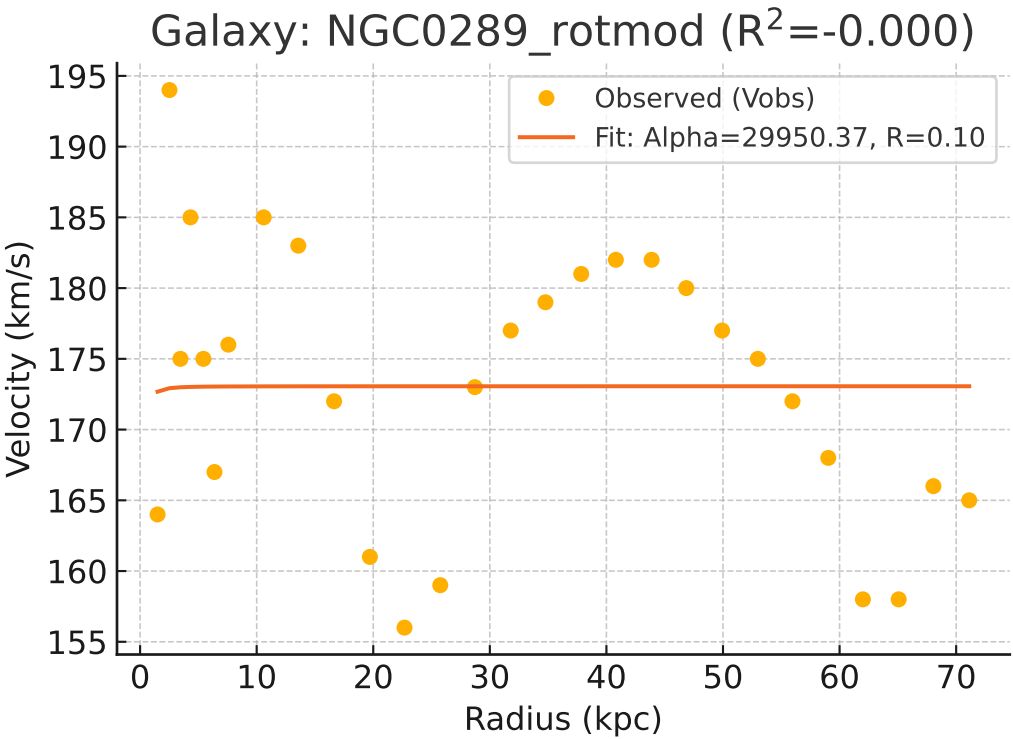

Galaxy: KK98-251_rotmod (R^2=0.984)
Observed (Vobs)
Fit: Alpha=2235.74, R=2.56
Velocity (km/s)
Radius (kpc)
5
10
15
20
25
30
35
0.5
1.0
1.5
2.0
2.5
3.0

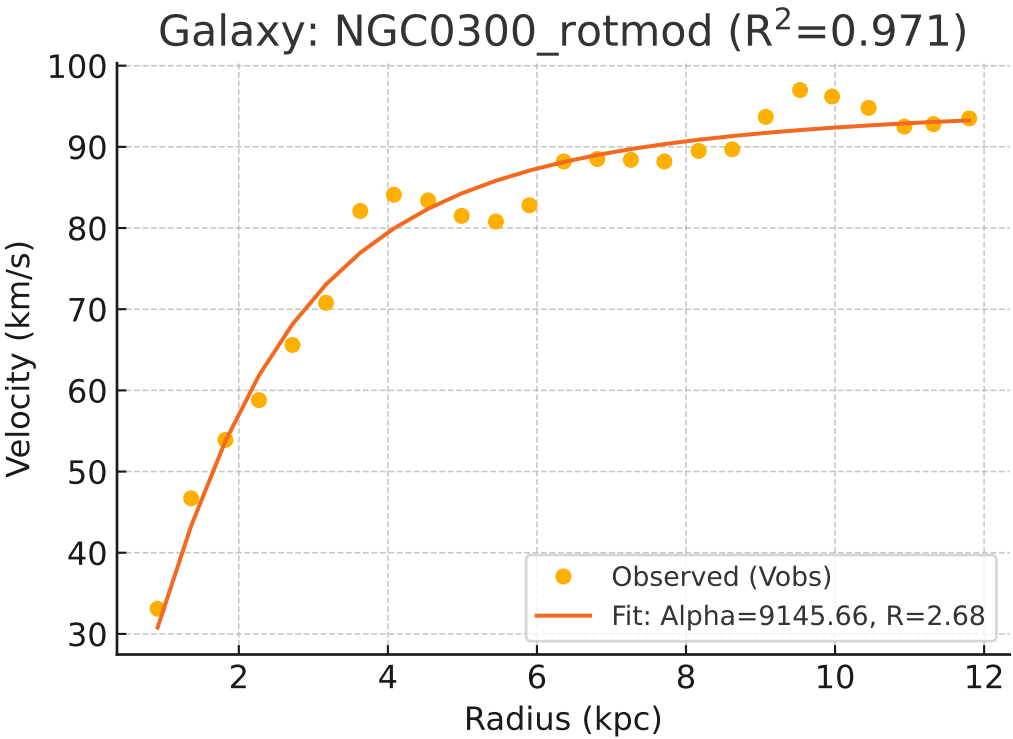

Galaxy: NGC0024_rotmod (R^2=0.987)
Velocity (km/s)
Radius (kpc)
20
40
60
80
100
0
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=12486.23, R=1.09

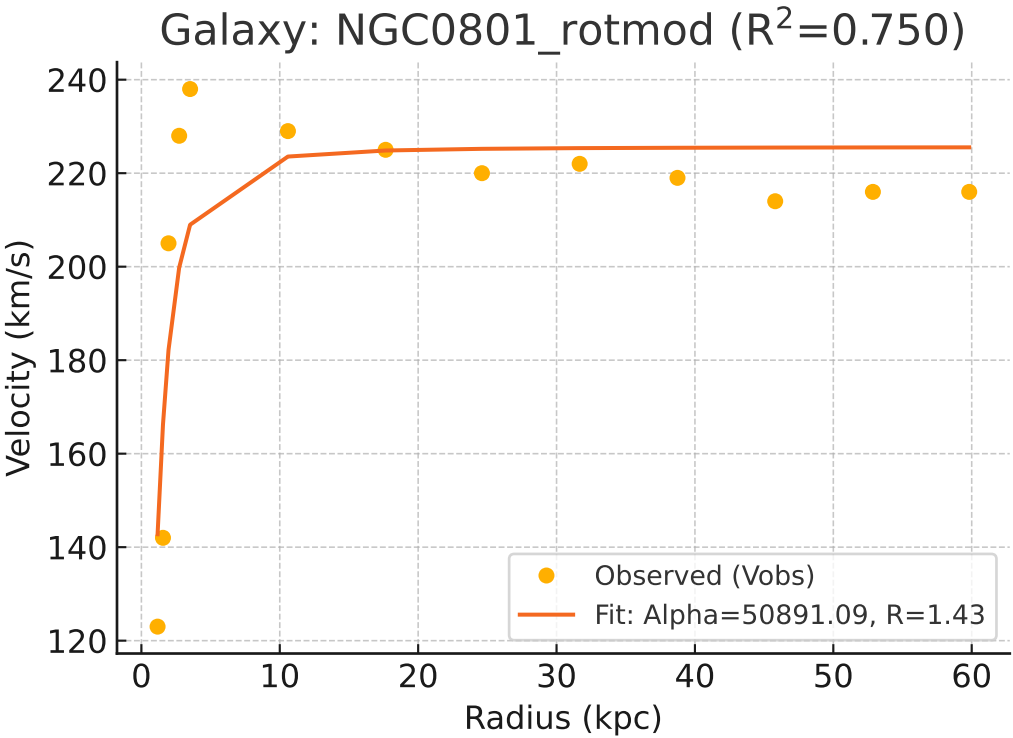

Galaxy: NGC0055_rotmod (R^2=0.989)
Velocity (km/s)
Radius (kpc)
90
80
70
60
50
40
30
2
4
6
8
10
12
14
Observed (Vobs)
Fit: Alpha=8708.07, R=4.45

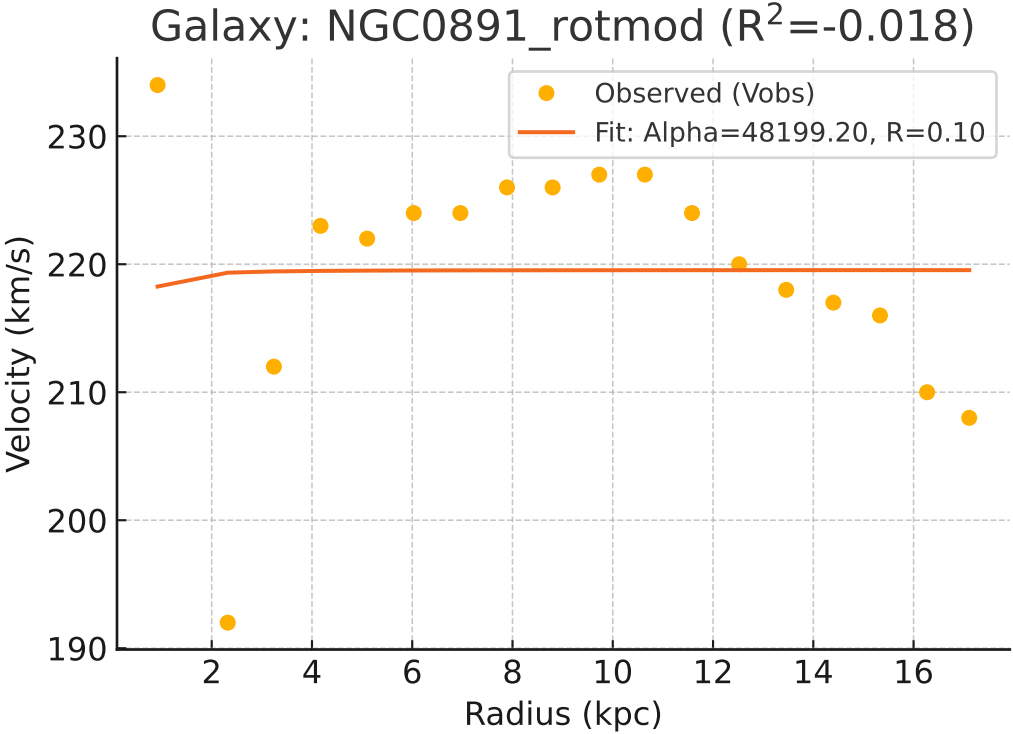

Galaxy: NGC0100_rotmod (R^2=0.996)
Velocity (km/s)
Radius (kpc)
20
40
60
80
0
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=8716.18, R=3.24

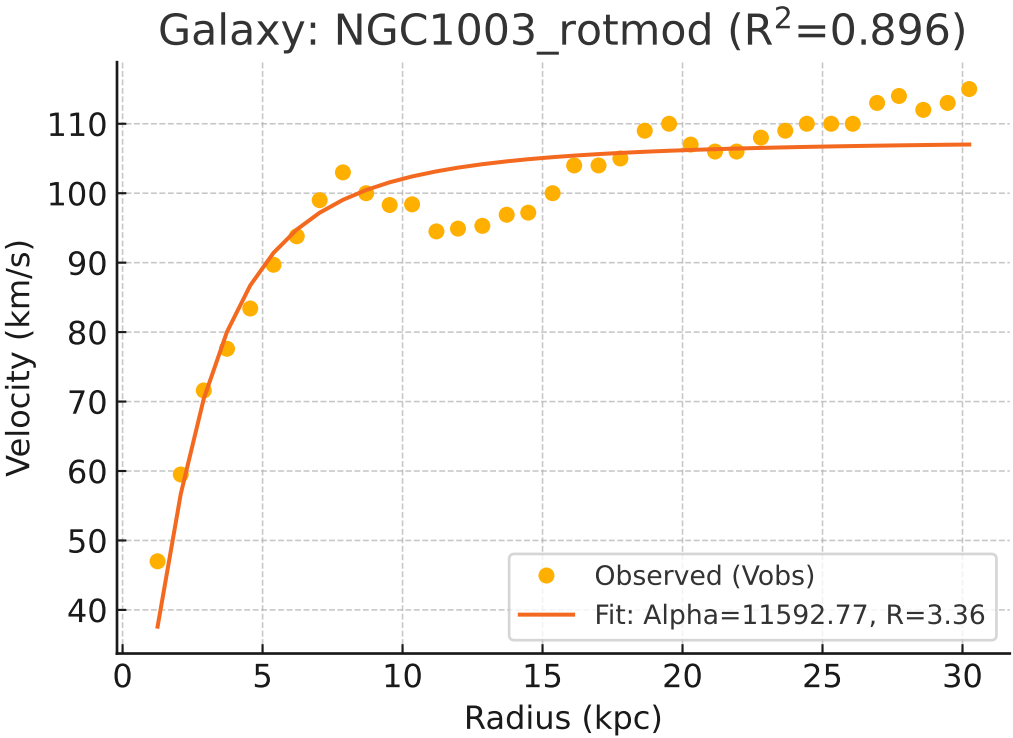

Galaxy: NGC0247_rotmod (R^2=0.913)
Observed (Vobs)
Fit: Alpha=11458.16, R=4.26
Velocity (km/s)
Radius (kpc)
110
100
90
80
70
60
50
40
30
2
4
6
8
10
12
14

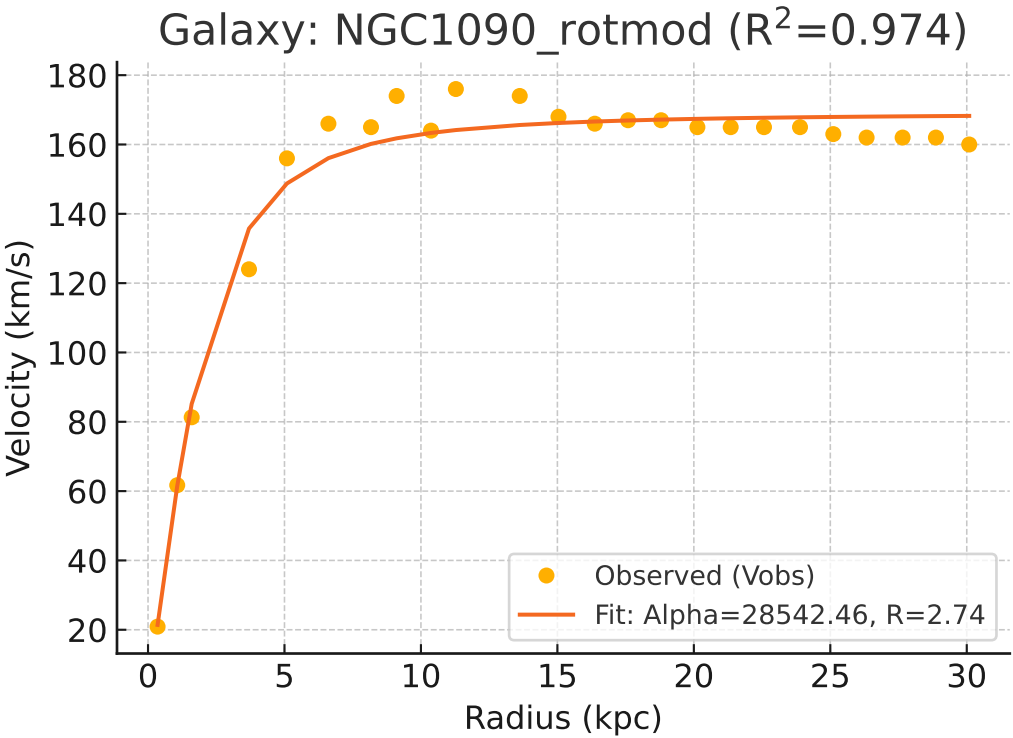

Galaxy: NGC0289_rotmod (R^2=-0.000)
Observed (Vobs)
Fit: Alpha=29950.37, R=0.10
Velocity (km/s)
Radius (kpc)
195
190
185
180
175
170
165
160
155
0
10
20
30
40
50
60
70

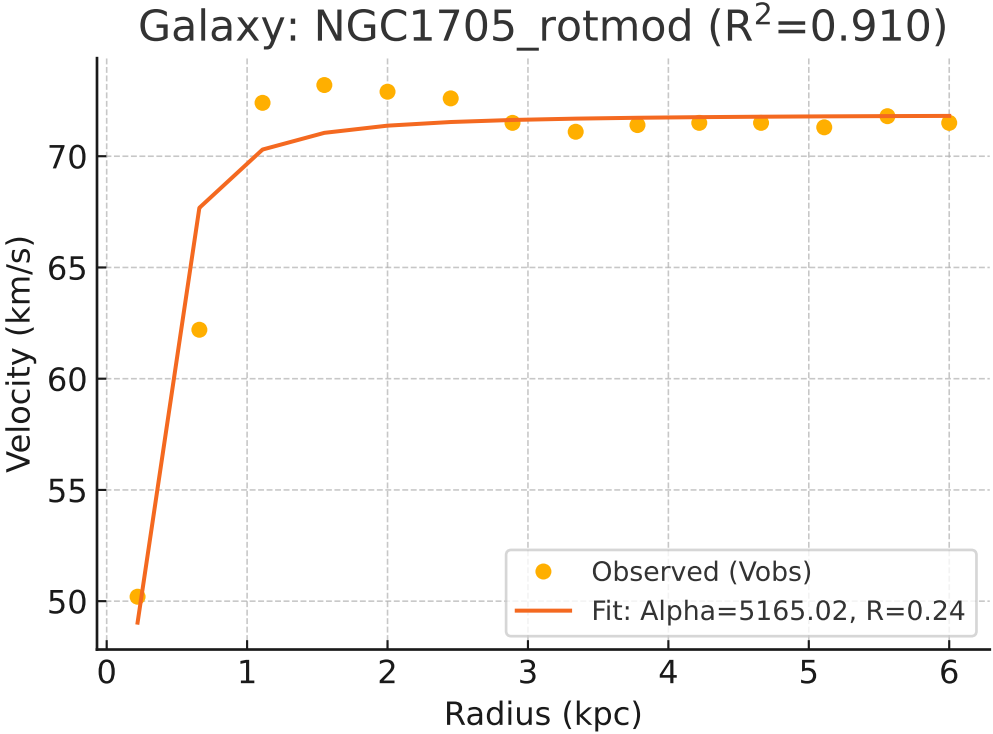

Galaxy: NGC0300_rotmod (R^2=0.971)
Velocity (km/s)
Radius (kpc)
100
90
80
70
60
50
40
30
2
4
6
8
10
12
Observed (Vobs)
Fit: Alpha=9145.66, R=2.68

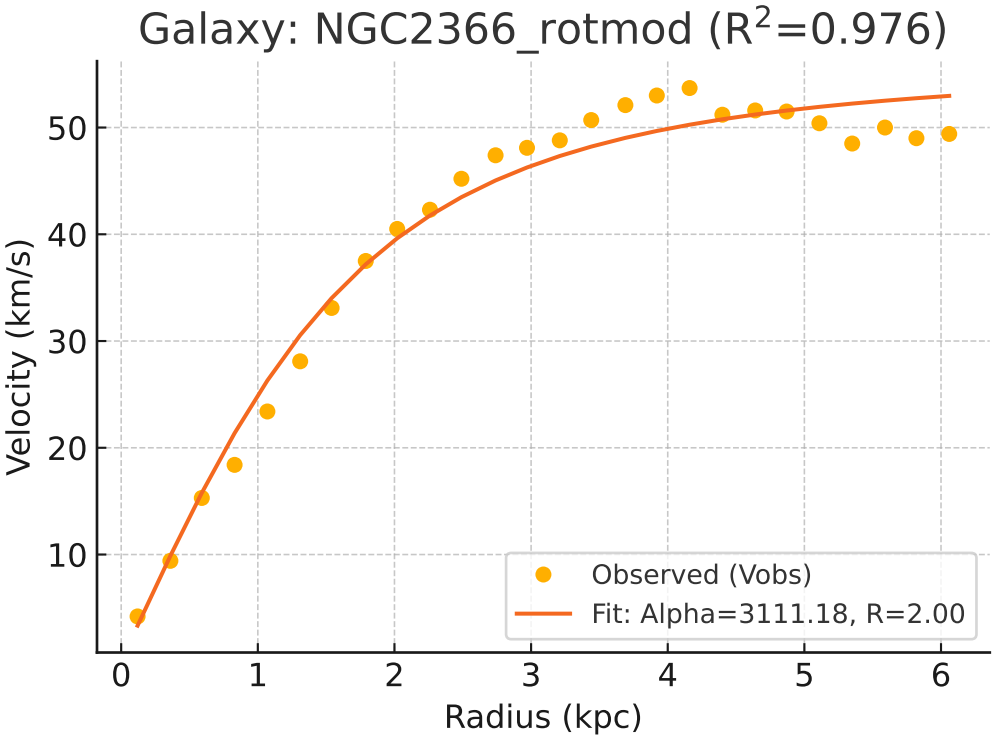

Galaxy: NGC0801_rotmod (R^2=0.750)
Velocity (km/s)
Radius (kpc)
240
220
200
180
160
140
120
0
10
20
30
40
50
60
Observed (Vobs)
Fit: Alpha=50891.09, R=1.43

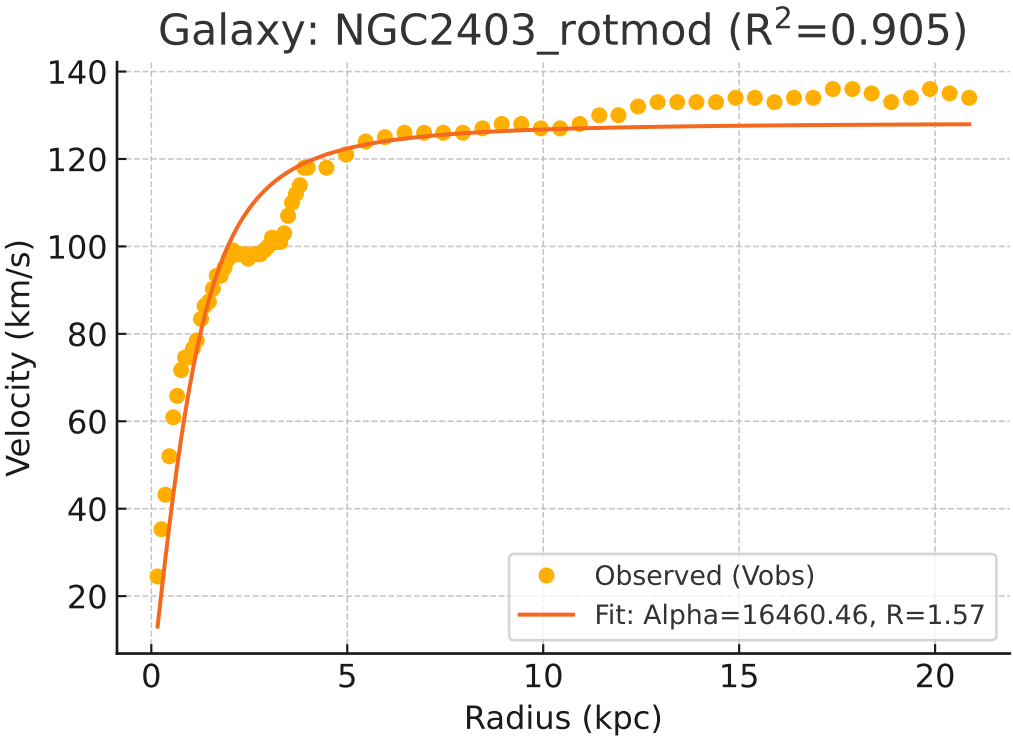

Galaxy: NGC0891_rotmod (R^2=-0.018)
Observed (Vobs)
Fit: Alpha=48199.20, R=0.10
Velocity (km/s)
Radius (kpc)
230
220
210
200
190
2
4
6
8
10
12
14
16

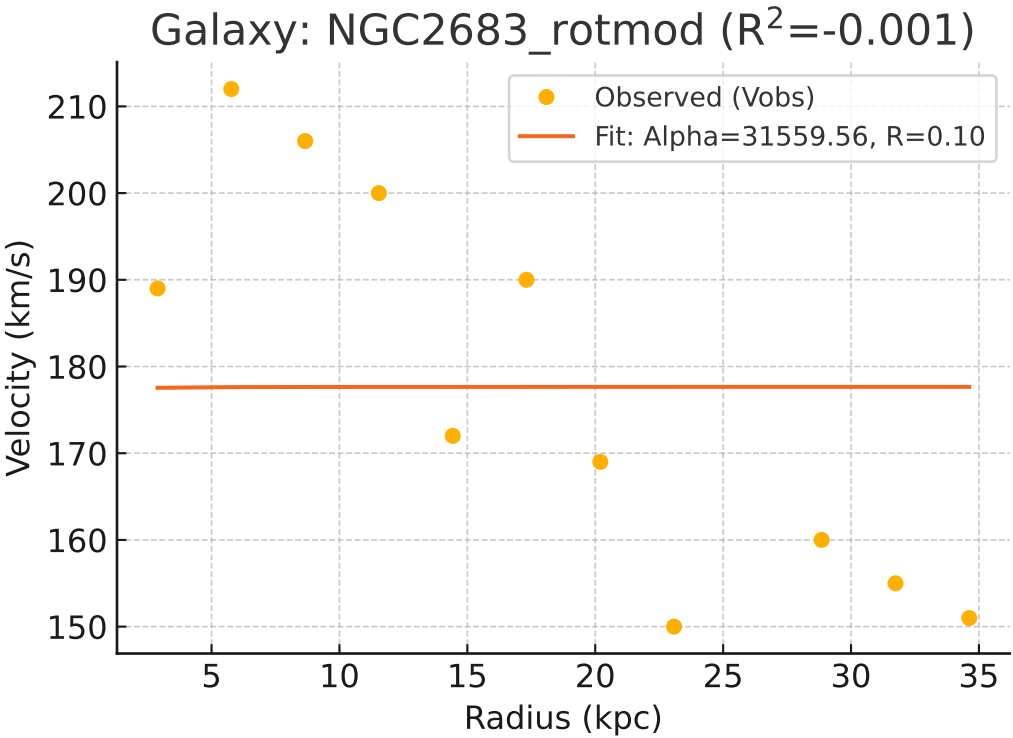

Galaxy: NGC1003_rotmod (R^2=0.896)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=11592.77, R=3.36
40
50
60
70
80
90
100
110
0
5
10
15
20
25
30

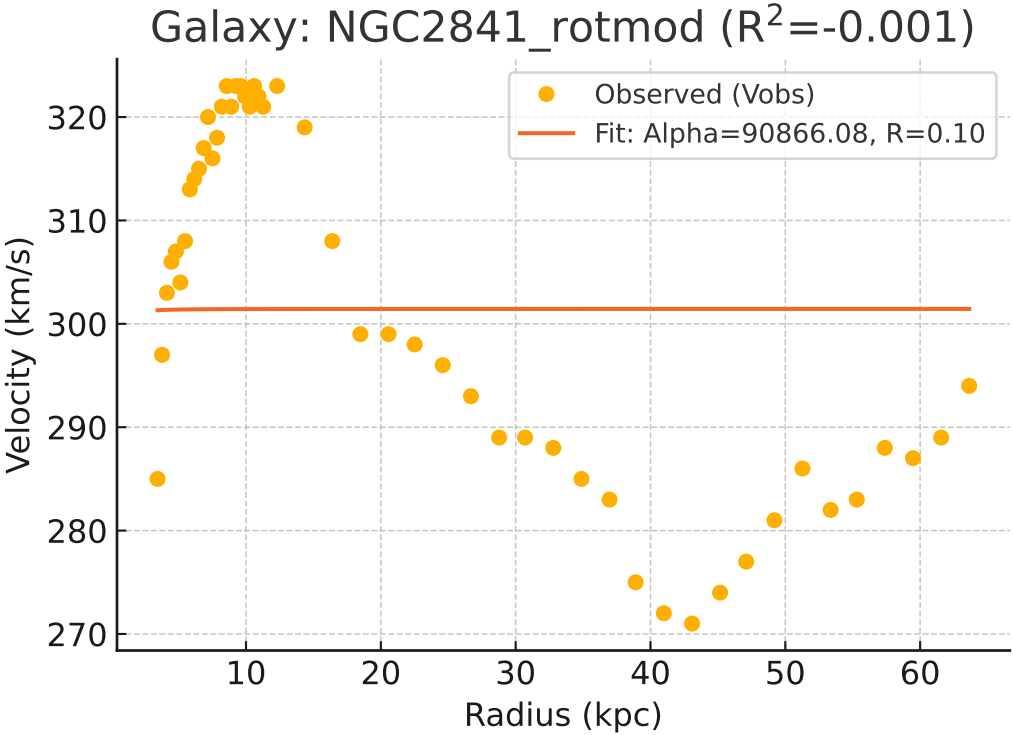

Galaxy: NGC1090_rotmod (R^2=0.974)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=28542.46, R=2.74
180
160
140
120
100
80
60
40
20
0
5
10
15
20
25
30

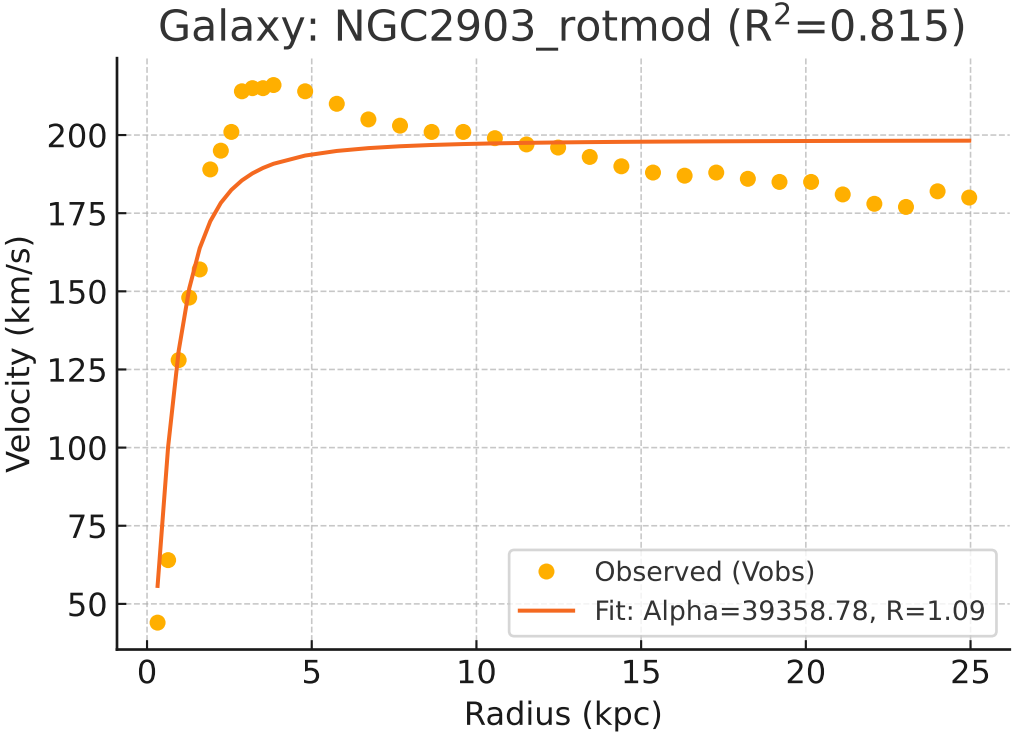

Galaxy: NGC1705_rotmod (R^2=0.910)
Velocity (km/s)
Radius (kpc)
70
65
60
55
50
0
1
2
3
4
5
6
Observed (Vobs)
Fit: Alpha=5165.02, R=0.24

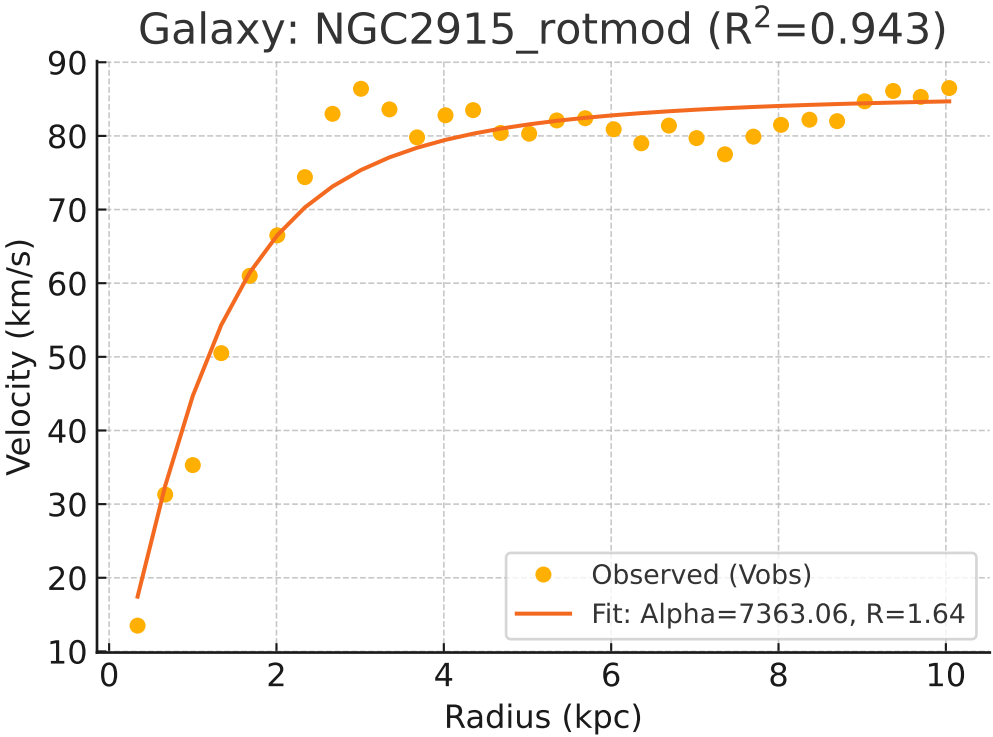

Galaxy: NGC2366_rotmod (R^2=0.976)
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
0
1
2
3
4
5
6
Observed (Vobs)
Fit: Alpha=3111.18, R=2.00

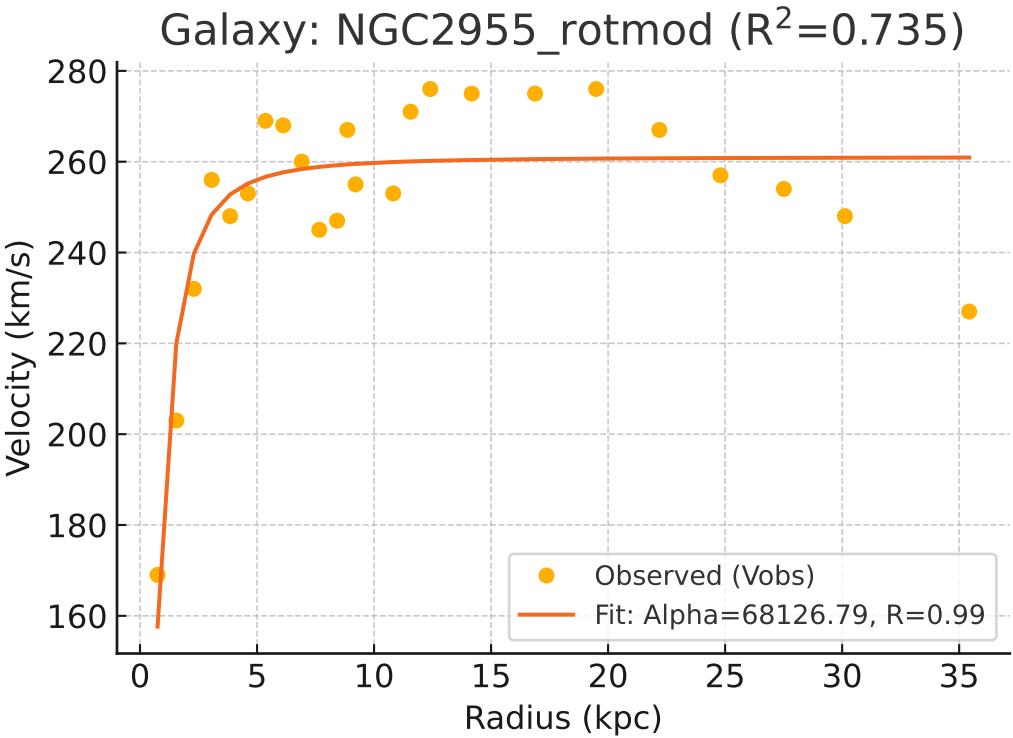

Galaxy: NGC2403_rotmod (R^2=0.905)
Velocity (km/s)
Radius (kpc)
140
120
100
80
60
40
20
0
5
10
15
20
Observed (Vobs)
Fit: Alpha=16460.46, R=1.57

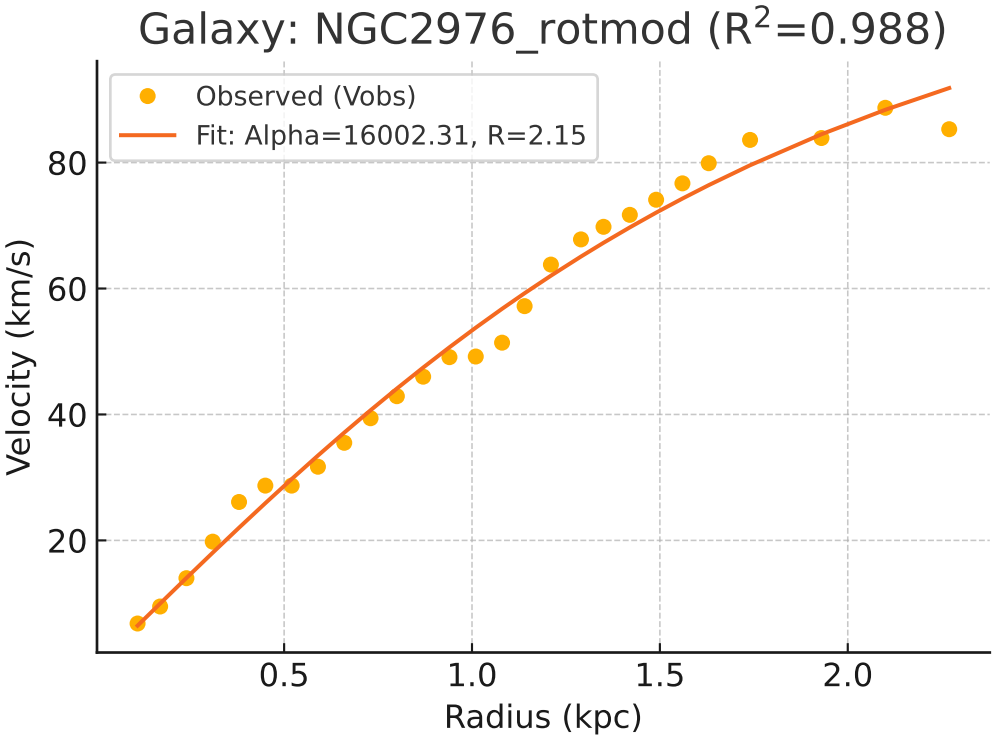

Galaxy: NGC2683_rotmod (R^2=-0.001)
Observed (Vobs)
Fit: Alpha=31559.56, R=0.10
Velocity (km/s)
Radius (kpc)
210
200
190
180
170
160
150
5
10
15
20
25
30
35

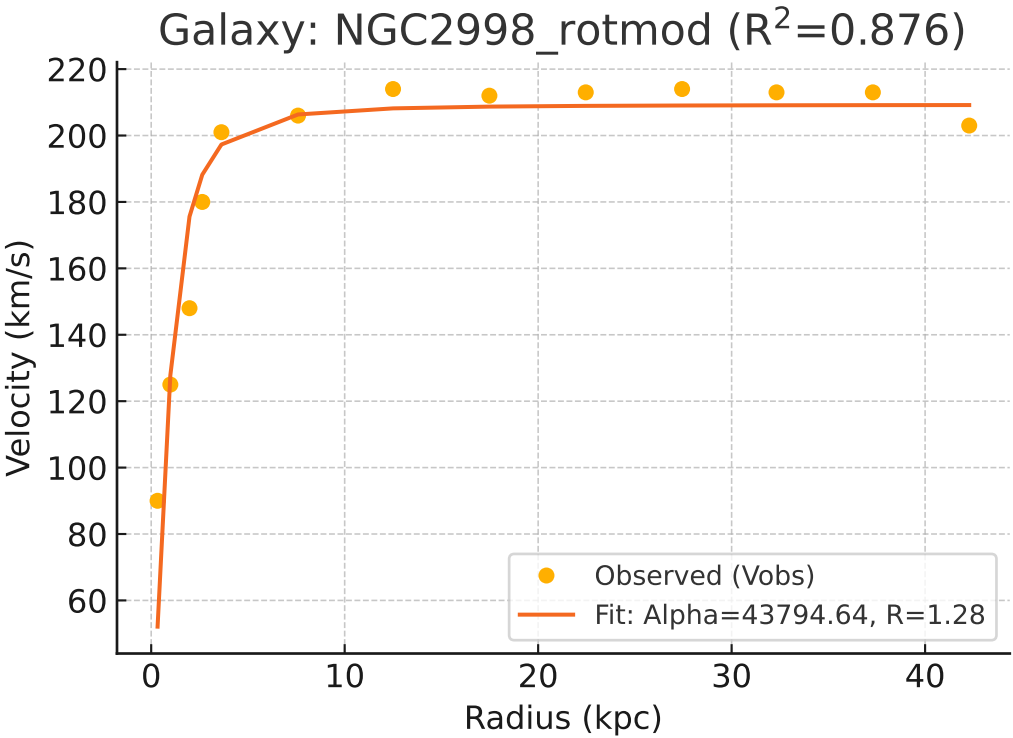

Galaxy: NGC2841_rotmod (R^2=-0.001)
Observed (Vobs)
Fit: Alpha=90866.08, R=0.10
Velocity (km/s)
Radius (kpc)
320
310
300
290
280
270
10
20
30
40
50
60

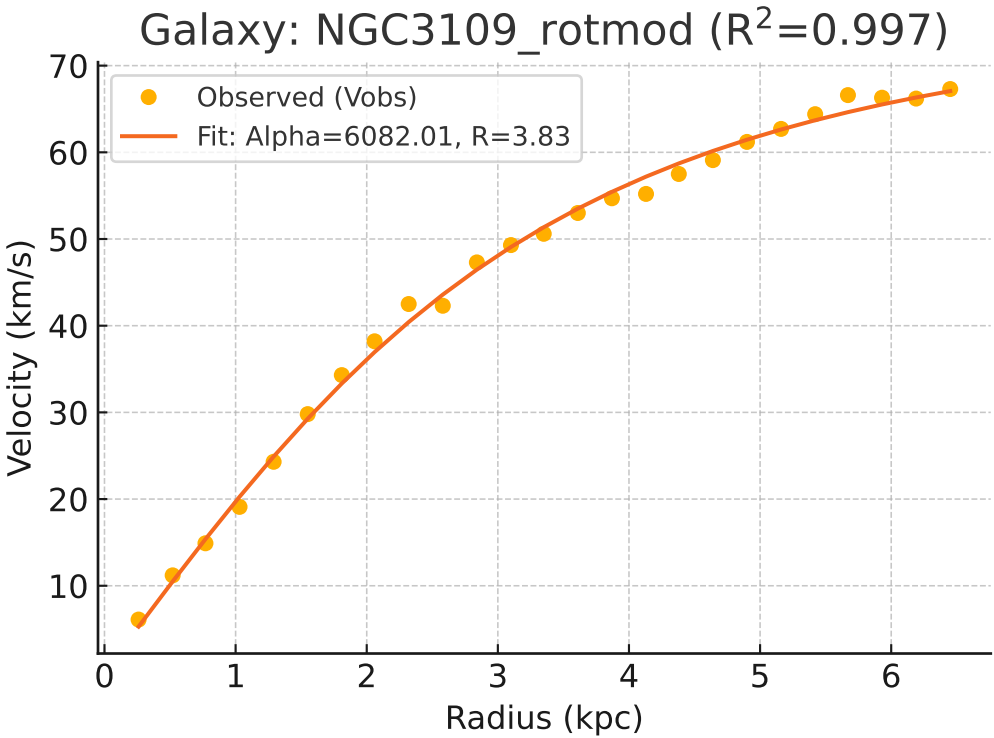

Galaxy: NGC2903_rotmod (R^2=0.815)
Velocity (km/s)
Radius (kpc)
50
75
100
125
150
175
200
0
5
10
15
20
25
Observed (Vobs)
Fit: Alpha=39358.78, R=1.09

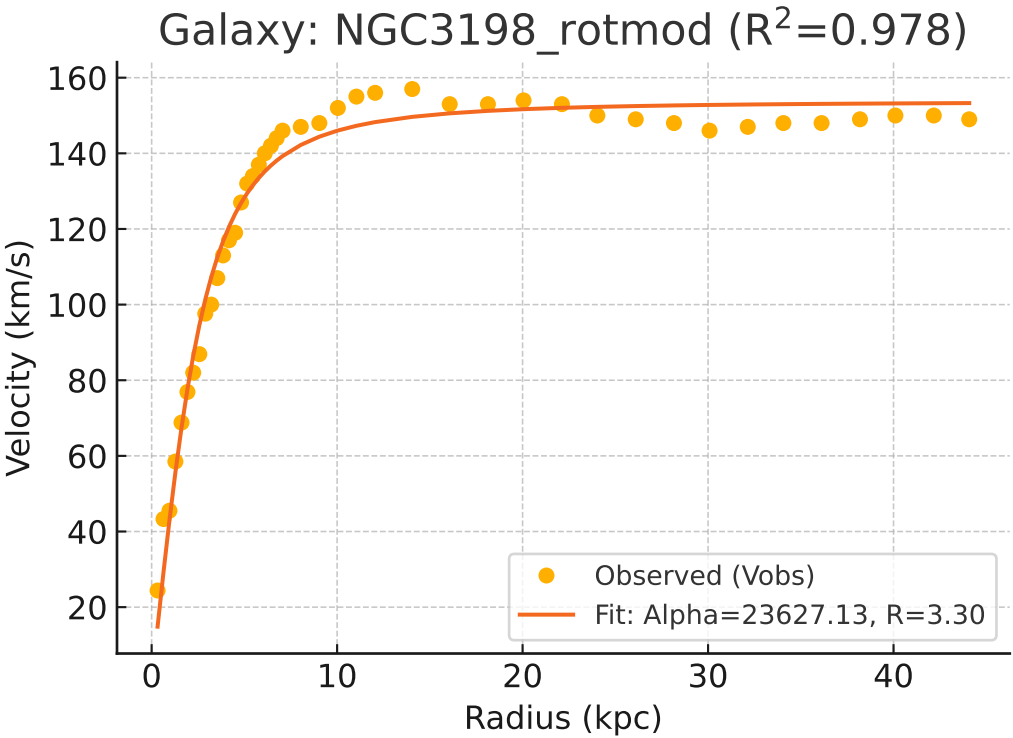

Galaxy: NGC2915_rotmod (R^2=0.943)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=7363.06, R=1.64
10
20
30
40
50
60
70
80
90
0
2
4
6
8
10

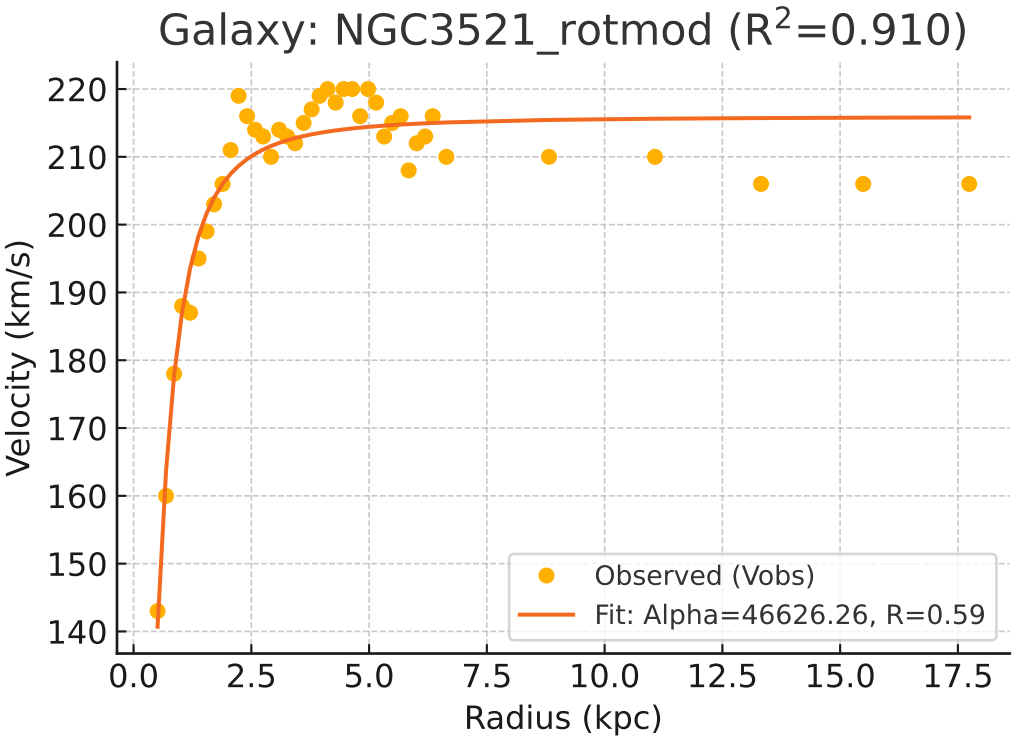

Galaxy: NGC2955_rotmod (R^2=0.735)
Velocity (km/s)
Radius (kpc)
280
260
240
220
200
180
160
0
5
10
15
20
25
30
35
Observed (Vobs)
Fit: Alpha=68126.79, R=0.99

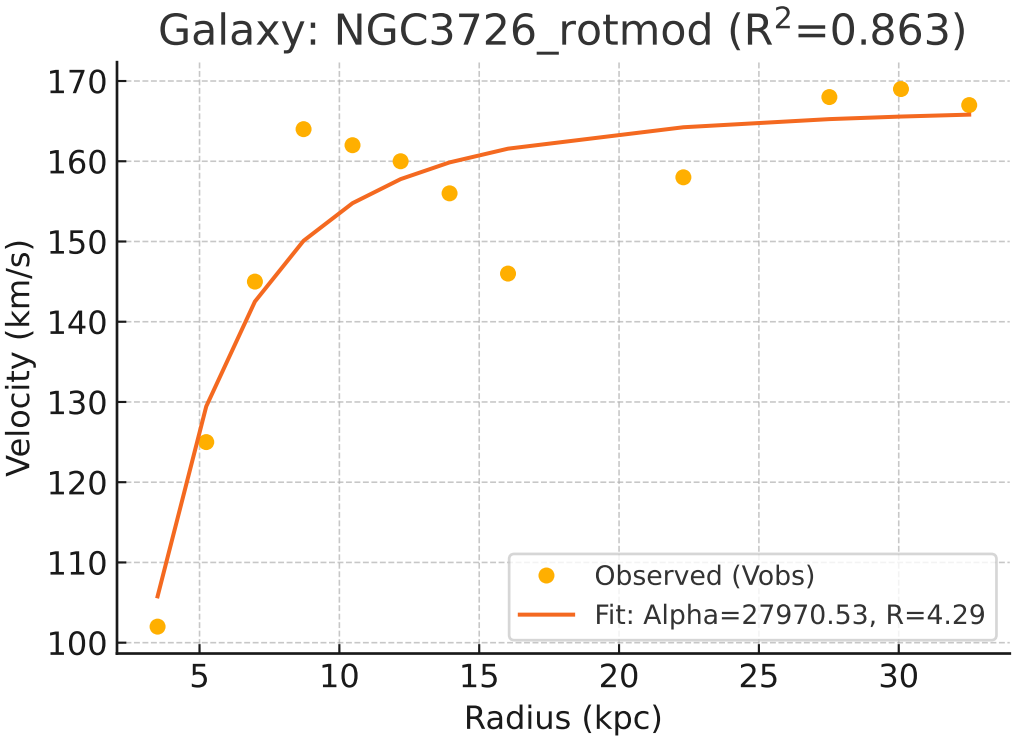

Galaxy: NGC2976_rotmod (R^2=0.988)
Observed (Vobs)
Fit: Alpha=16002.31, R=2.15
Velocity (km/s)
Radius (kpc)
20
40
60
80
0.5
1.0
1.5
2.0

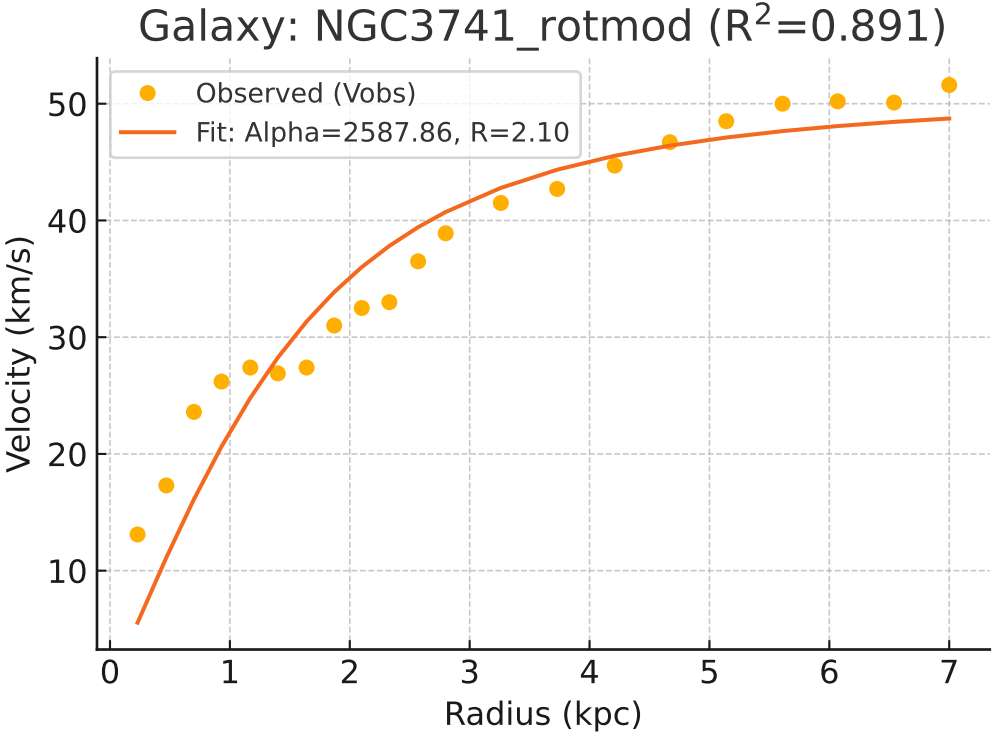

Galaxy: NGC2998_rotmod (R^2=0.876)
Velocity (km/s)
Radius (kpc)
220
200
180
160
140
120
100
80
60
0
10
20
30
40
Observed (Vobs)
Fit: Alpha=43794.64, R=1.28

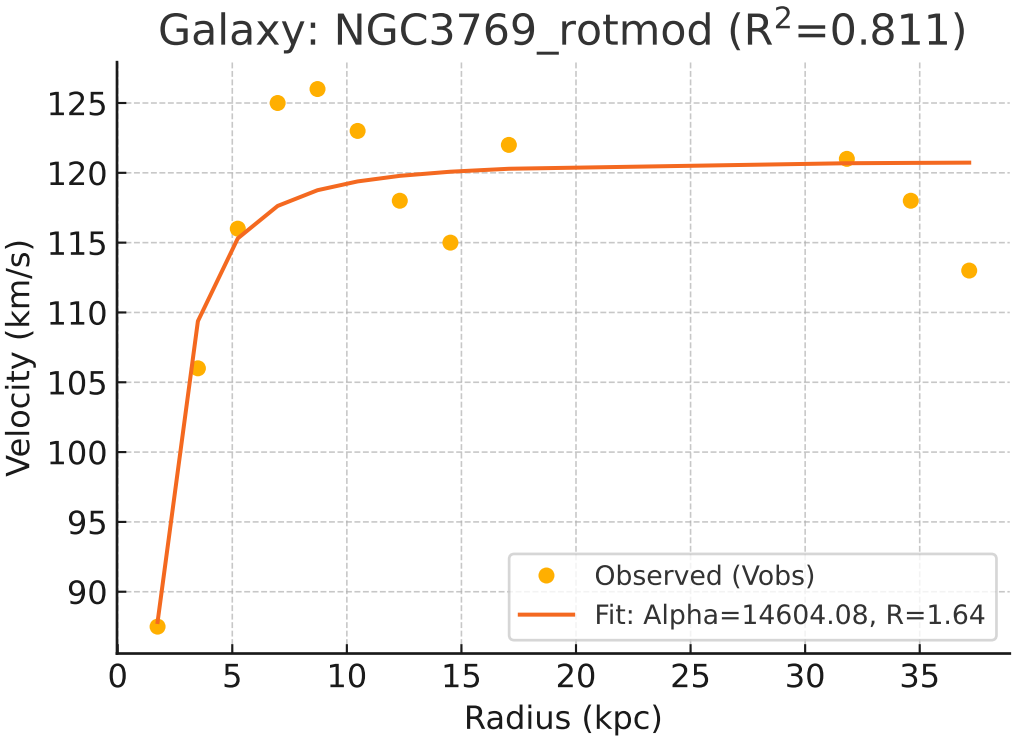

Galaxy: NGC3109_rotmod (R^2=0.997)
Observed (Vobs)
Fit: Alpha=6082.01, R=3.83
Velocity (km/s)
Radius (kpc)
70
60
50
40
30
20
10
0
1
2
3
4
5
6

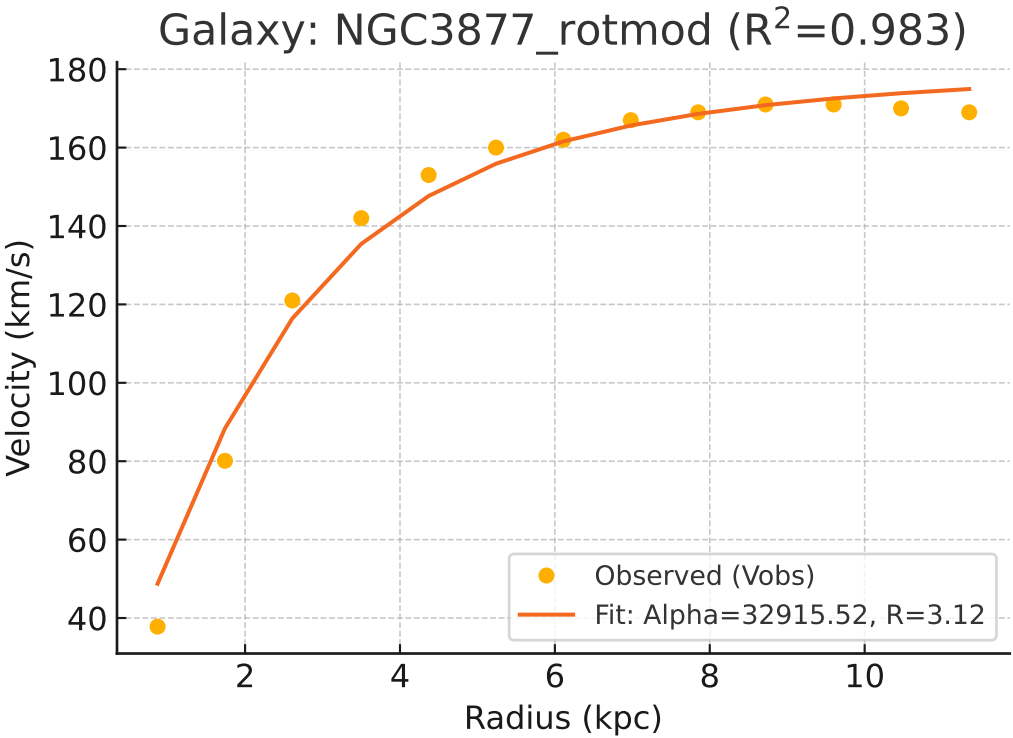

Galaxy: NGC3198_rotmod (R^2=0.978)
Velocity (km/s)
Radius (kpc)
160
140
120
100
80
60
40
20
0
10
20
30
40
Observed (Vobs)
Fit: Alpha=23627.13, R=3.30

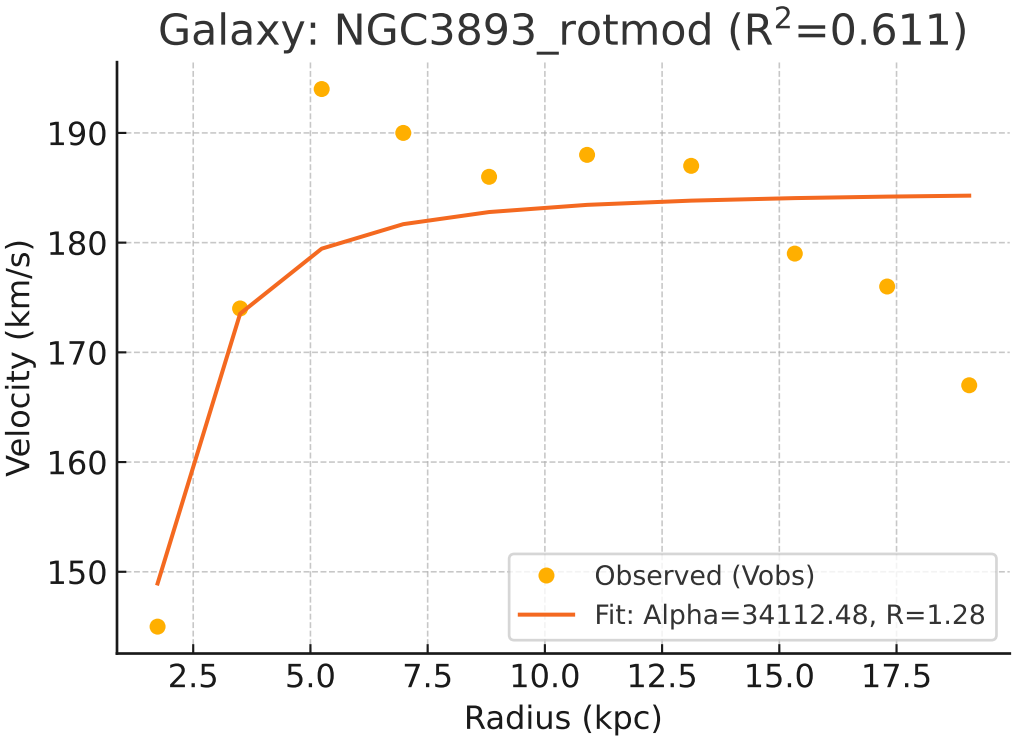

Galaxy: NGC3521_rotmod (R^2=0.910)
Velocity (km/s)
Radius (kpc)
220
210
200
190
180
170
160
150
140
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
Observed (Vobs)
Fit: Alpha=46626.26, R=0.59

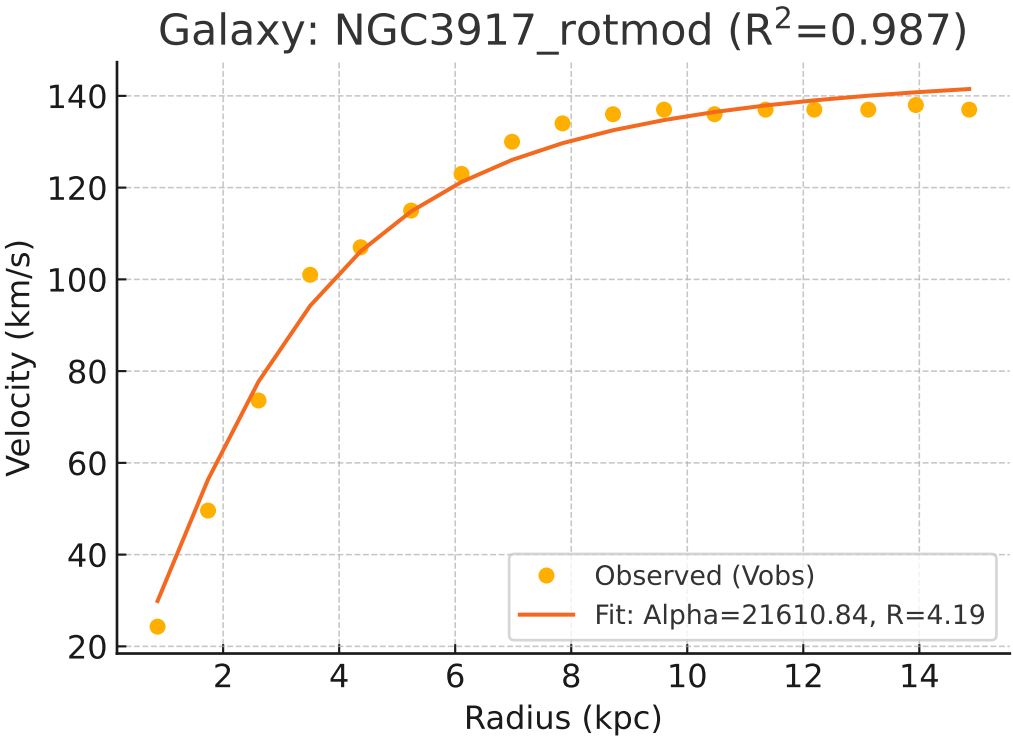

Galaxy: NGC3726_rotmod (R^2=0.863)
Velocity (km/s)
Radius (kpc)
170
160
150
140
130
120
110
100
5
10
15
20
25
30
Observed (Vobs)
Fit: Alpha=27970.53, R=4.29

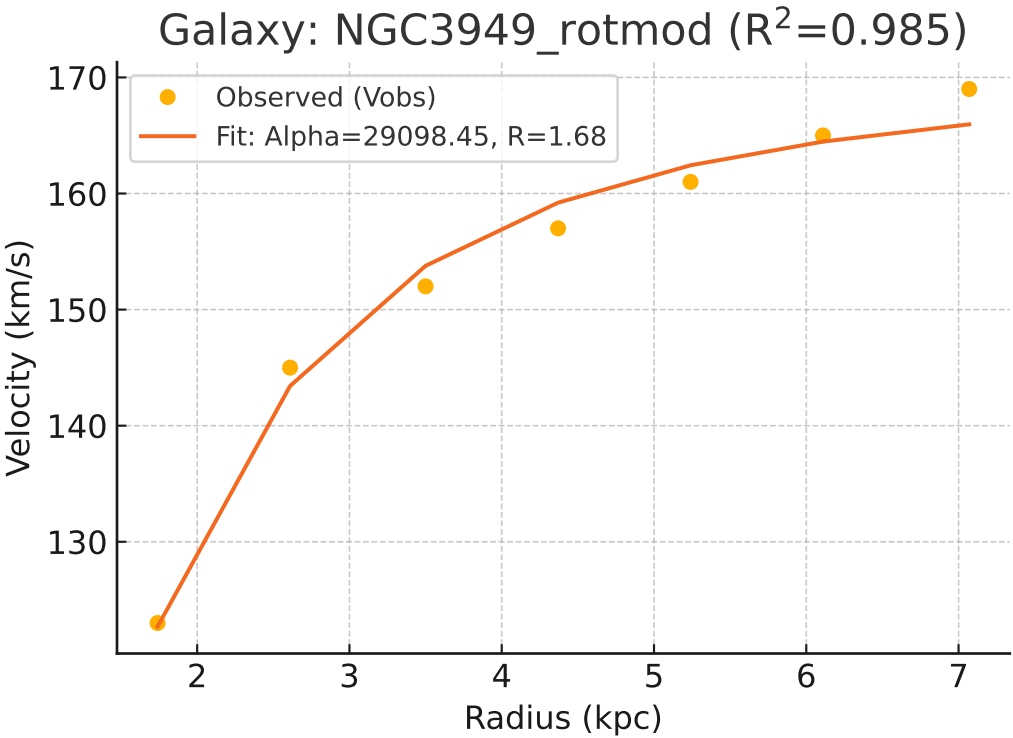

Galaxy: NGC3741_rotmod (R^2=0.891)
Observed (Vobs)
Fit: Alpha=2587.86, R=2.10
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
0
1
2
3
4
5
6
7

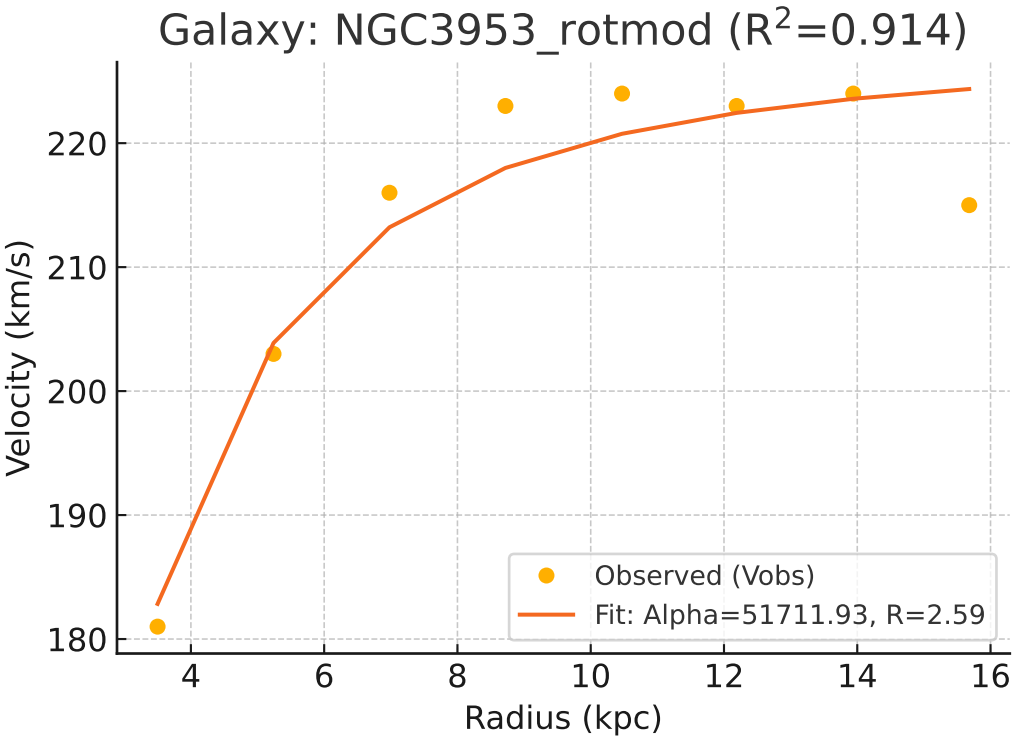

Galaxy: NGC3769_rotmod (R^2=0.811)
Velocity (km/s)
Radius (kpc)
125
120
115
110
105
100
95
90
0
5
10
15
20
25
30
35
Observed (Vobs)
Fit: Alpha=14604.08, R=1.64

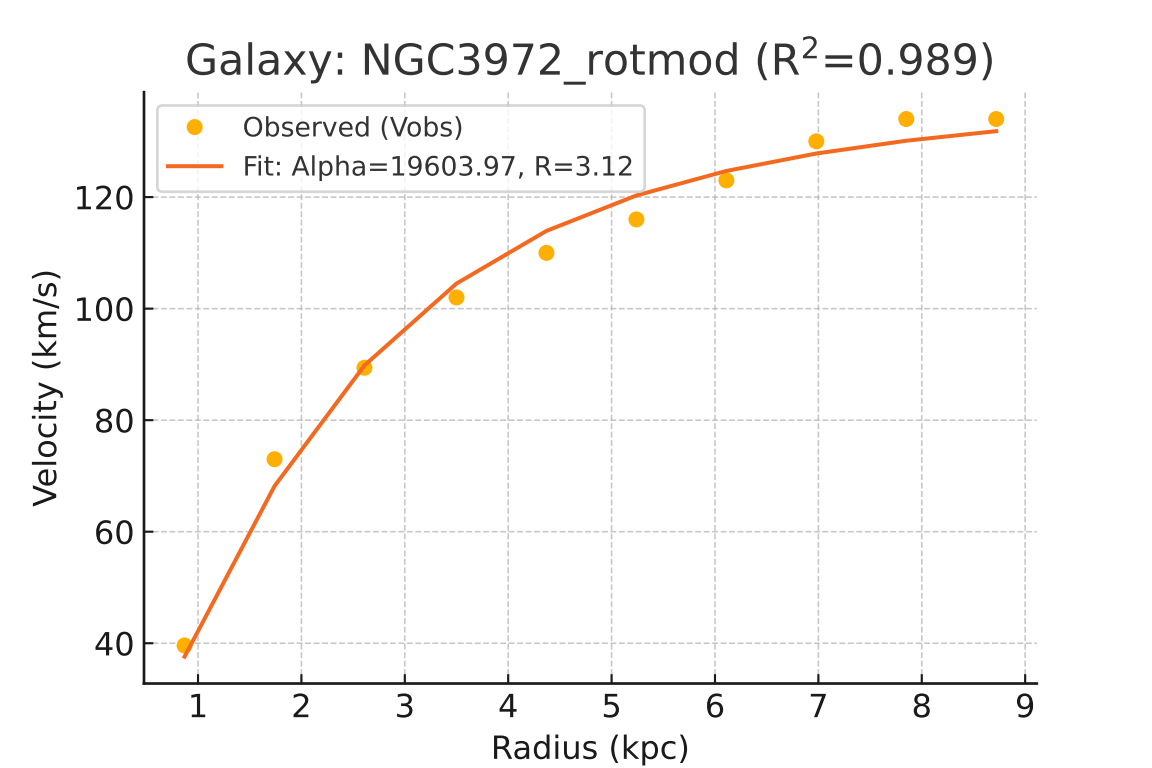

Galaxy: NGC3877_rotmod (R^2=0.983)
Velocity (km/s)
Radius (kpc)
180
160
140
120
100
80
60
40
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=32915.52, R=3.12

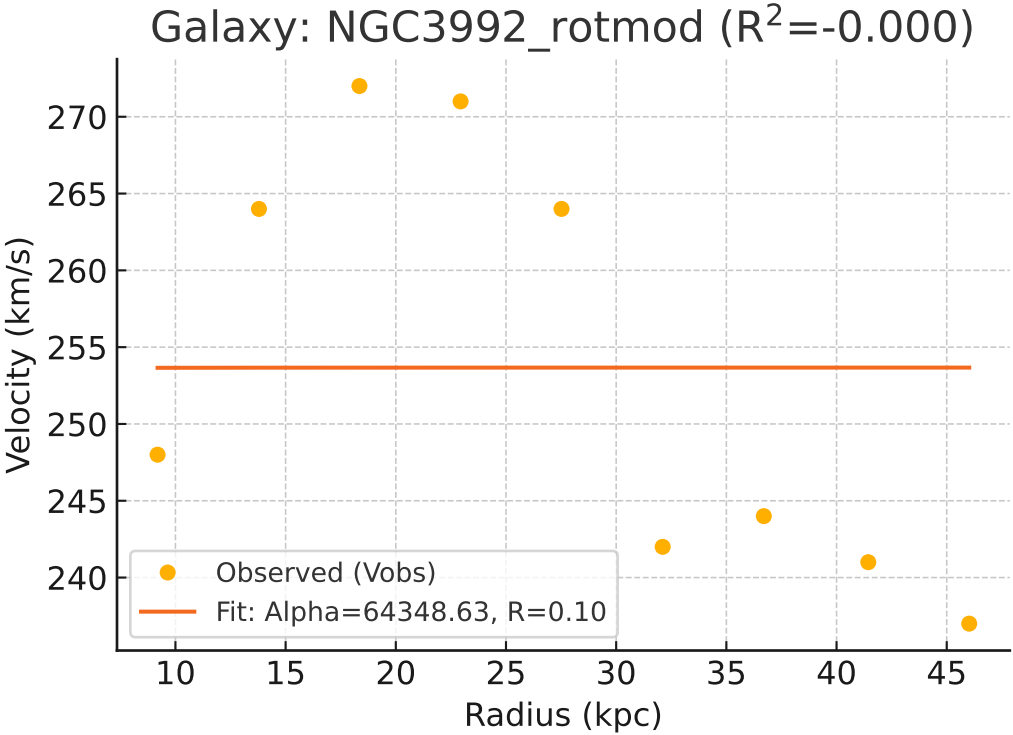

Galaxy: NGC3893_rotmod (R^2=0.611)
Velocity (km/s)
Radius (kpc)
190
180
170
160
150
2.5
5.0
7.5
10.0
12.5
15.0
17.5
Observed (Vobs)
Fit: Alpha=34112.48, R=1.28

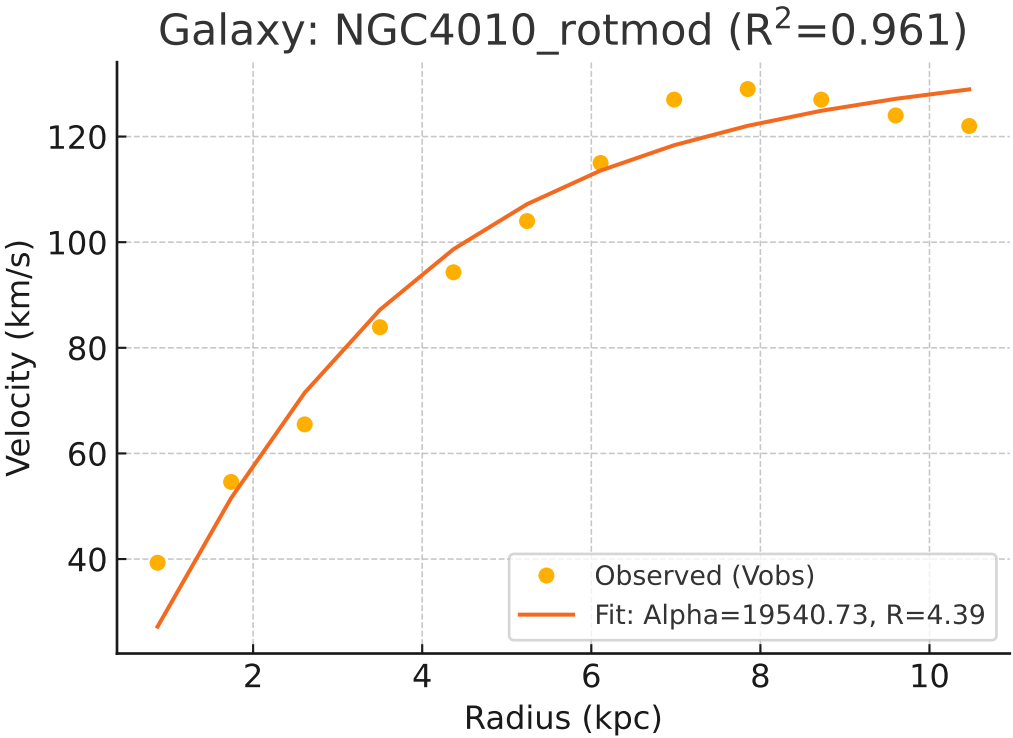

Galaxy: NGC3917_rotmod (R^2=0.987)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=21610.84, R=4.19

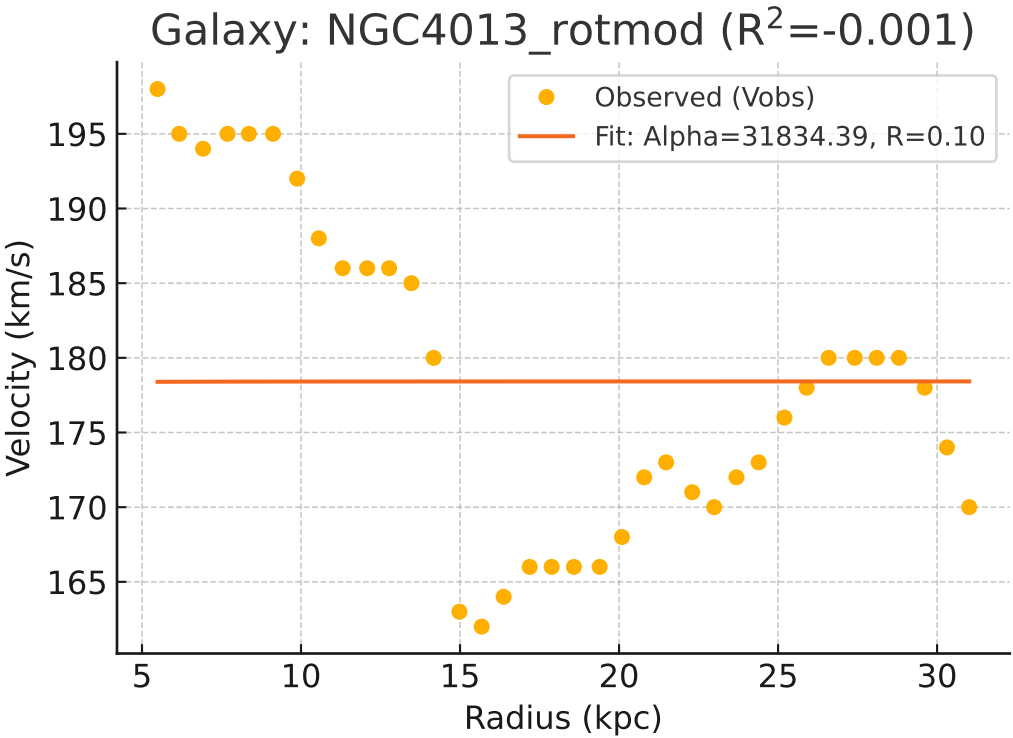

Galaxy: NGC3949_rotmod (R^2=0.985)
Observed (Vobs)
Fit: Alpha=29098.45, R=1.68
Velocity (km/s)
Radius (kpc)
170
160
150
140
130
2
3
4
5
6
7

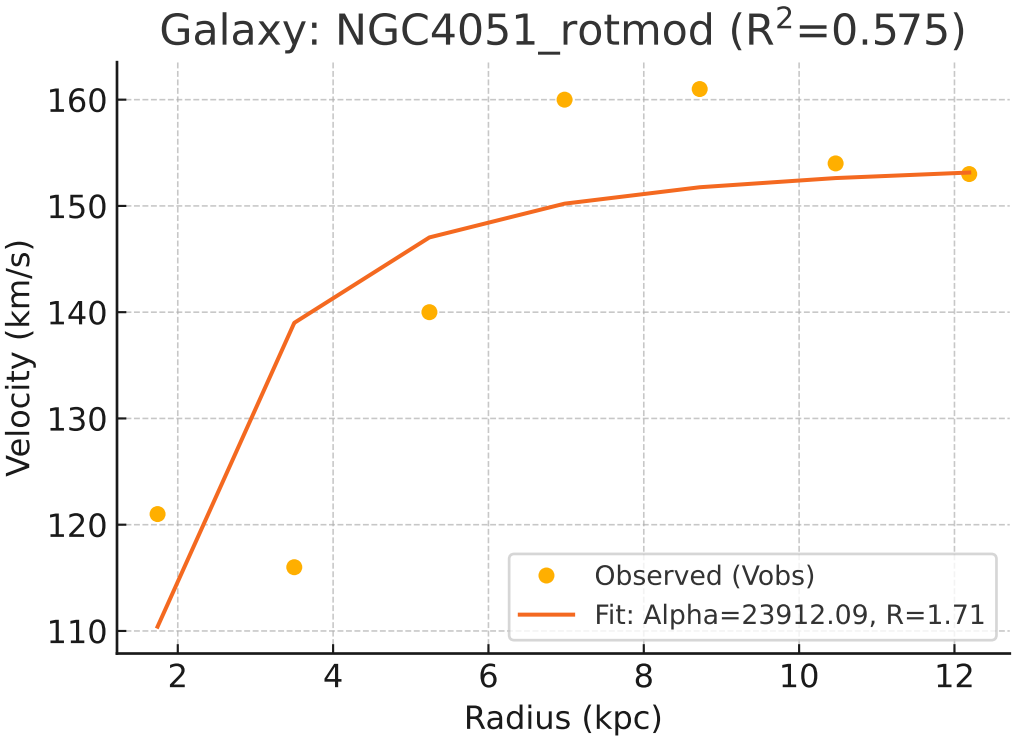

Galaxy: NGC3953_rotmod (R^2=0.914)
Velocity (km/s)
Radius (kpc)
180
190
200
210
220
4
6
8
10
12
14
16
Observed (Vobs)
Fit: Alpha=51711.93, R=2.59

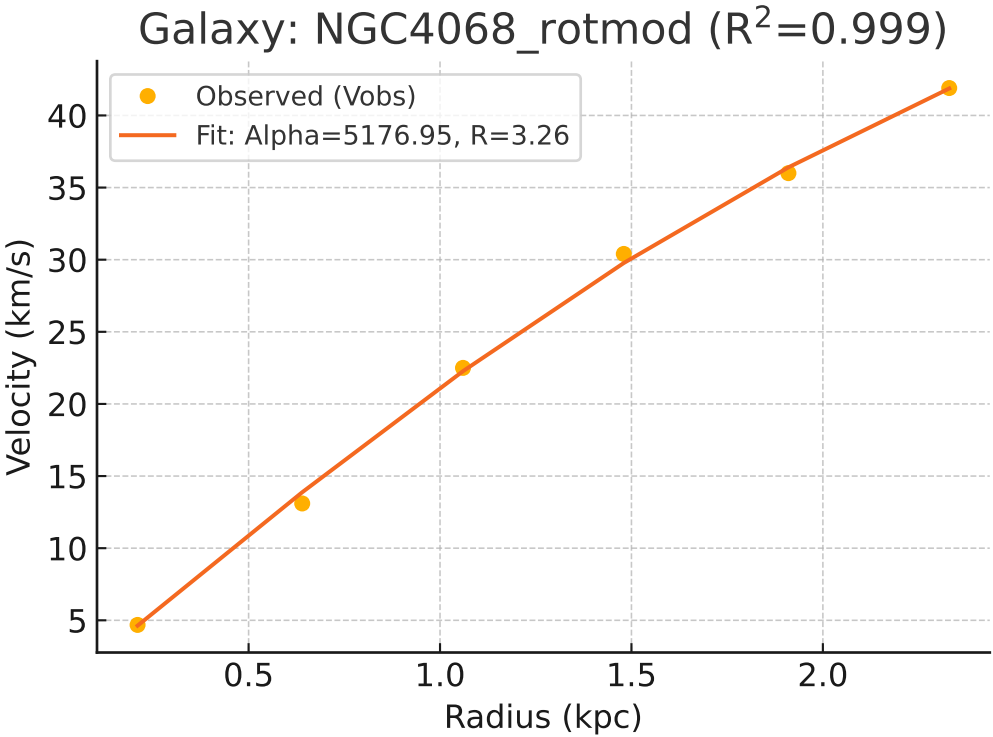

Galaxy: NGC3972_rotmod (R^2=0.989)
Observed (Vobs)
Fit: Alpha=19603.97, R=3.12
Velocity (km/s)
Radius (kpc)
40
60
80
100
120
1
2
3
4
5
6
7
8
9

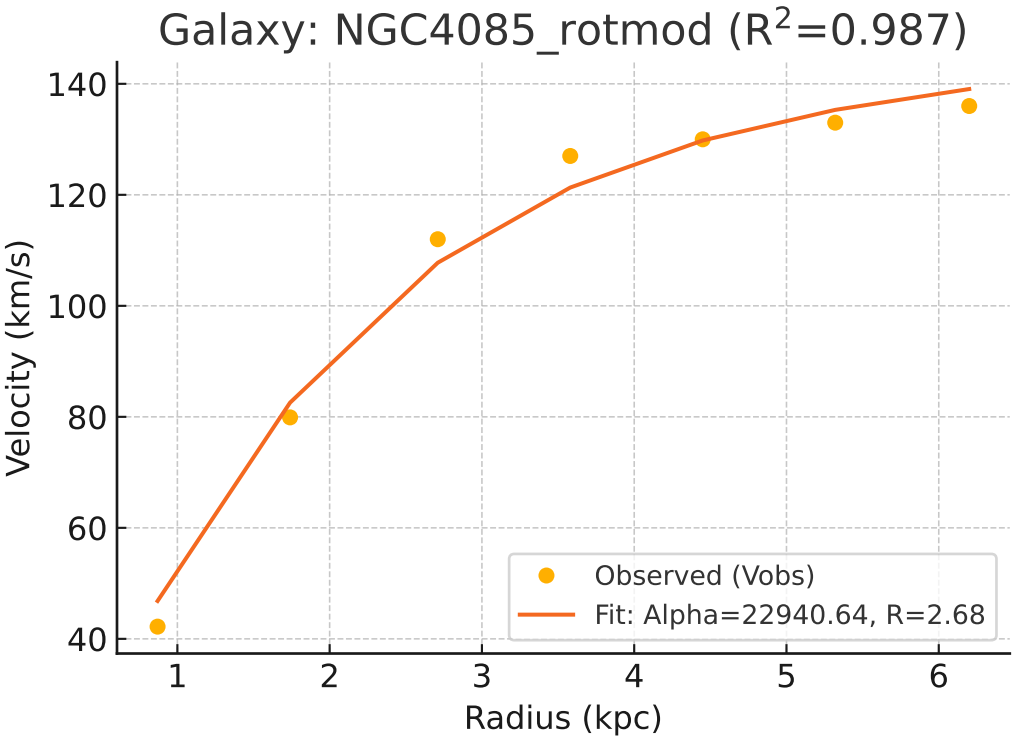

Galaxy: NGC3992_rotmod (R^2=-0.000)
Velocity (km/s)
Radius (kpc)
270
265
260
255
250
245
240
10
15
20
25
30
35
40
45
Observed (Vobs)
Fit: Alpha=64348.63, R=0.10

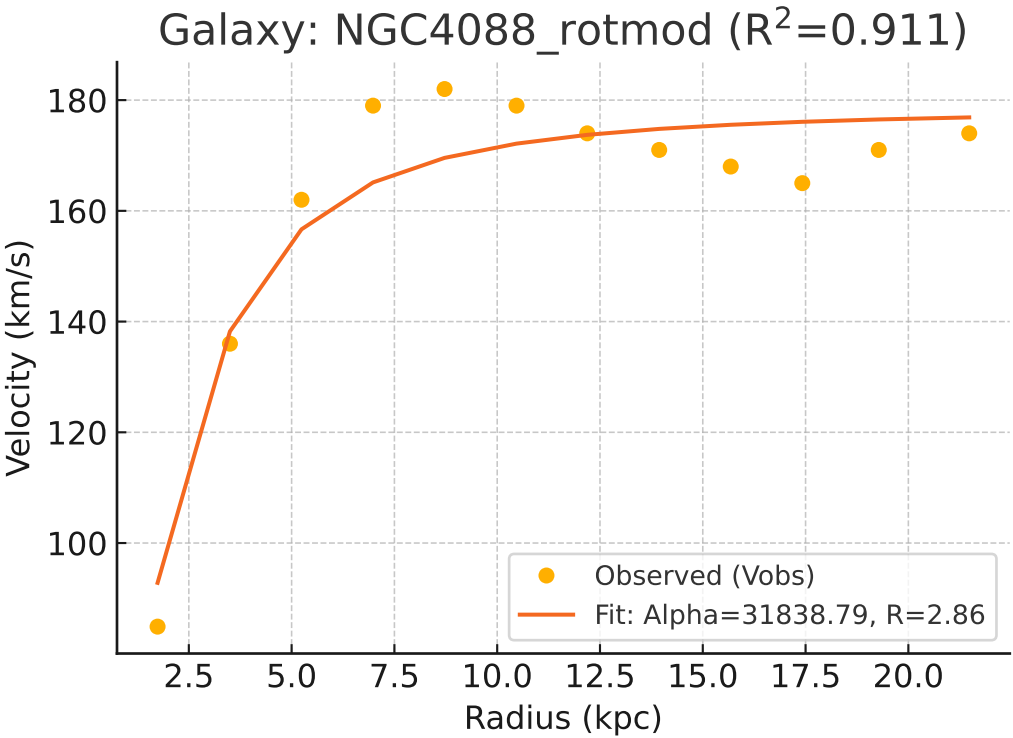

Galaxy: NGC4010_rotmod (R^2=0.961)
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=19540.73, R=4.39

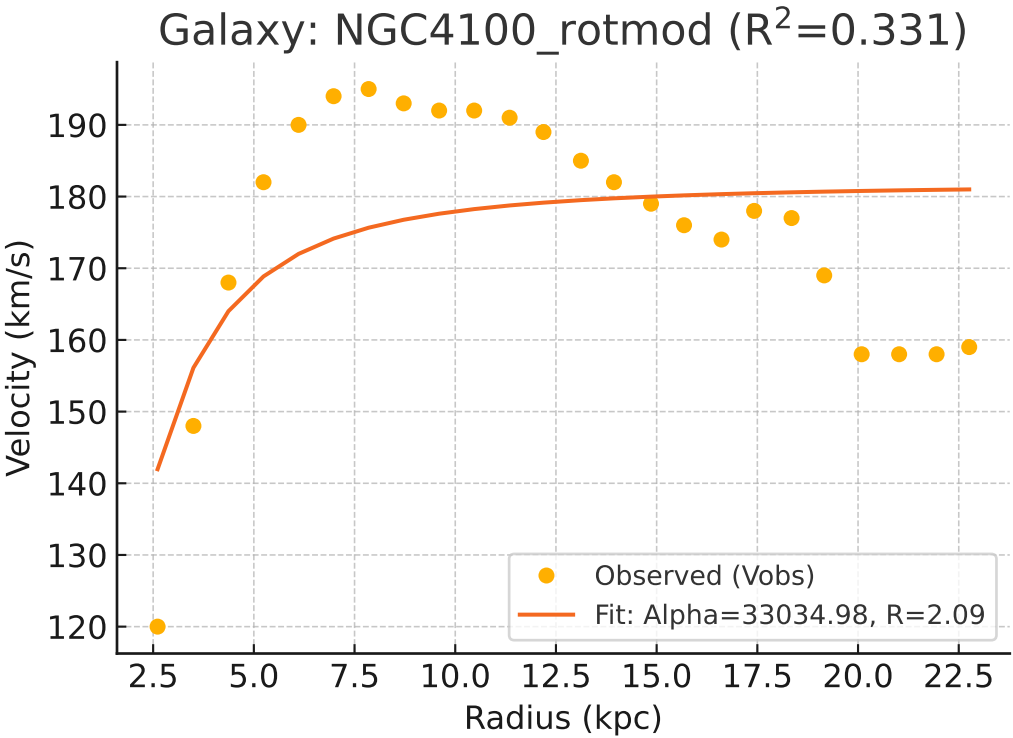

Galaxy: NGC4013_rotmod (R^2=-0.001)
Observed (Vobs)
Fit: Alpha=31834.39, R=0.10
Velocity (km/s)
Radius (kpc)
195
190
185
180
175
170
165
5
10
15
20
25
30

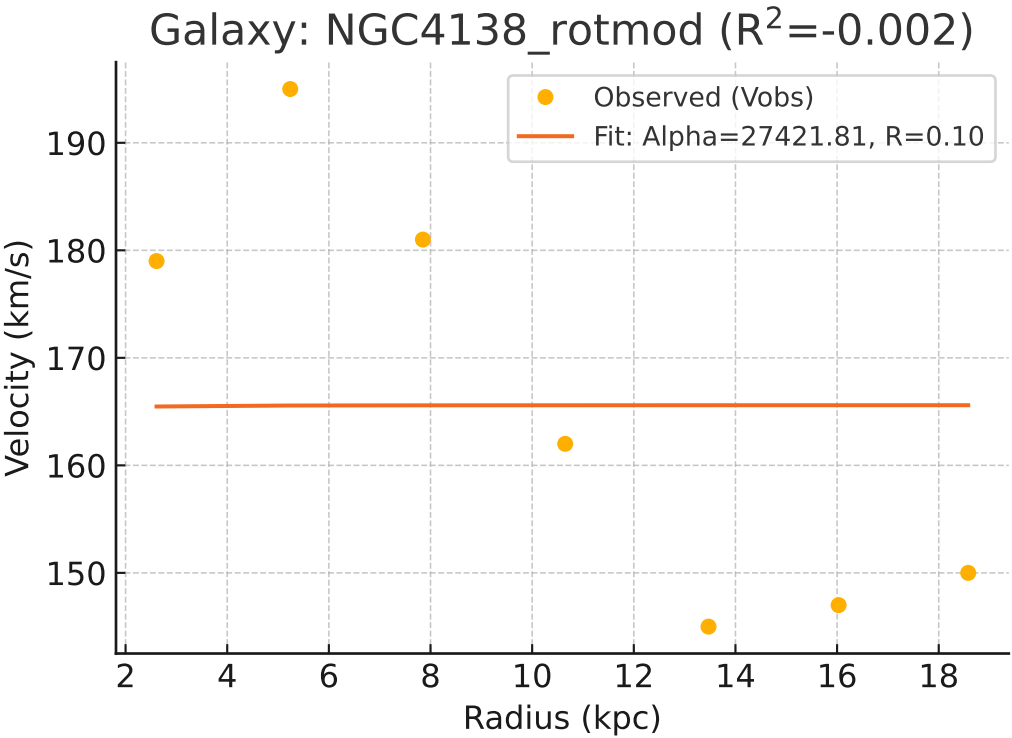

Galaxy: NGC4051_rotmod (R^2=0.575)
Velocity (km/s)
Radius (kpc)
160
150
140
130
120
110
2
4
6
8
10
12
Observed (Vobs)
Fit: Alpha=23912.09, R=1.71

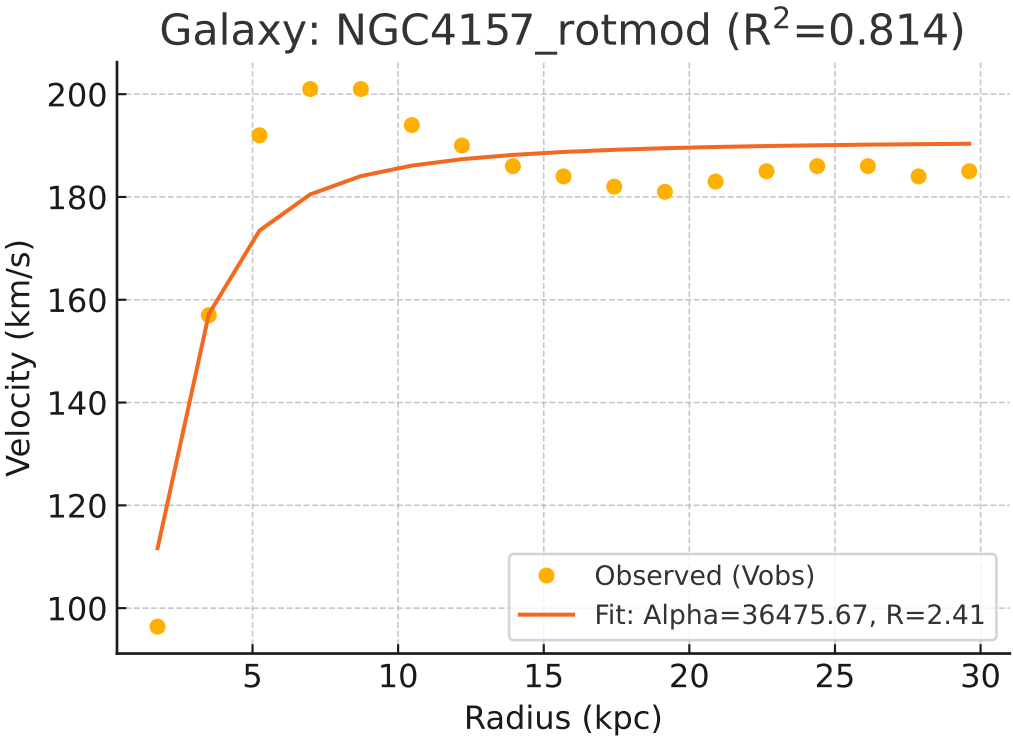

Galaxy: NGC4068_rotmod (R^2=0.999)
Observed (Vobs)
Fit: Alpha=5176.95, R=3.26
Velocity (km/s)
Radius (kpc)
5
10
15
20
25
30
35
40
0.5
1.0
1.5
2.0

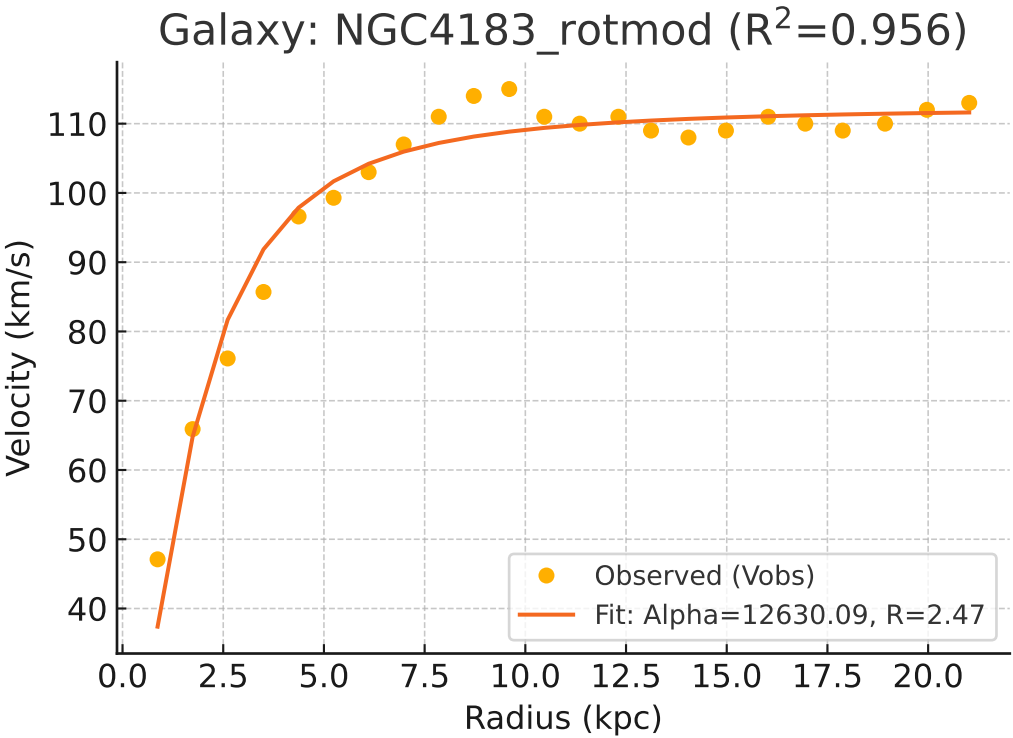

Galaxy: NGC4085_rotmod (R^2=0.987)
Velocity (km/s)
Radius (kpc)
140
120
100
80
60
40
1
2
3
4
5
6
Observed (Vobs)
Fit: Alpha=22940.64, R=2.68

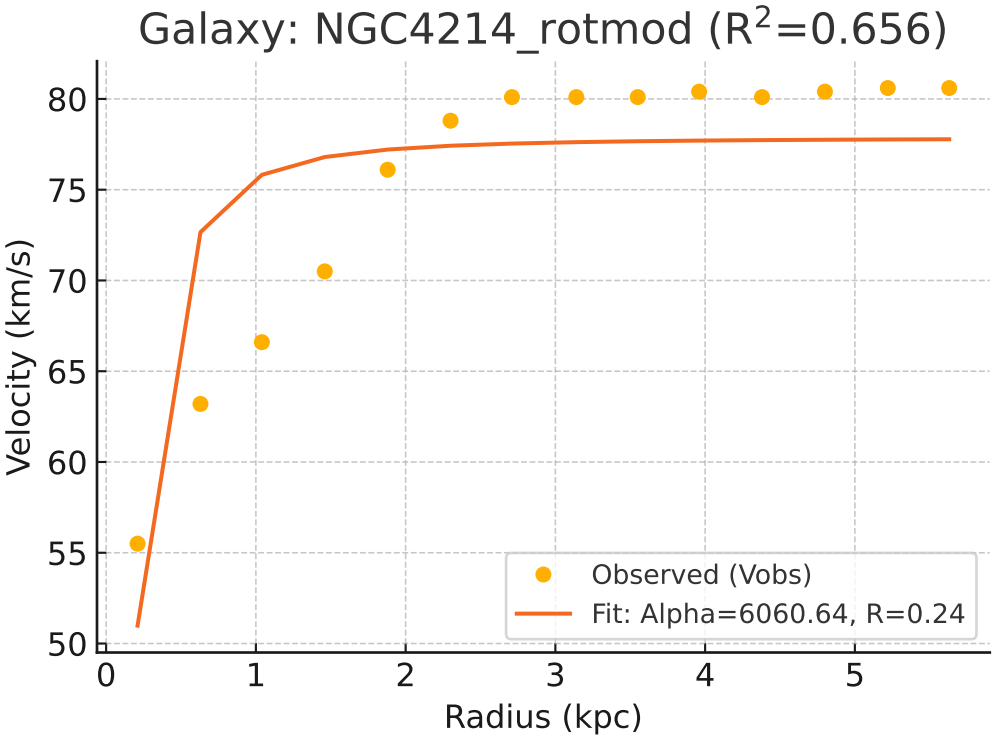

Galaxy: NGC4088_rotmod (R^2=0.911)
Velocity (km/s)
Radius (kpc)
180
160
140
120
100
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Observed (Vobs)
Fit: Alpha=31838.79, R=2.86

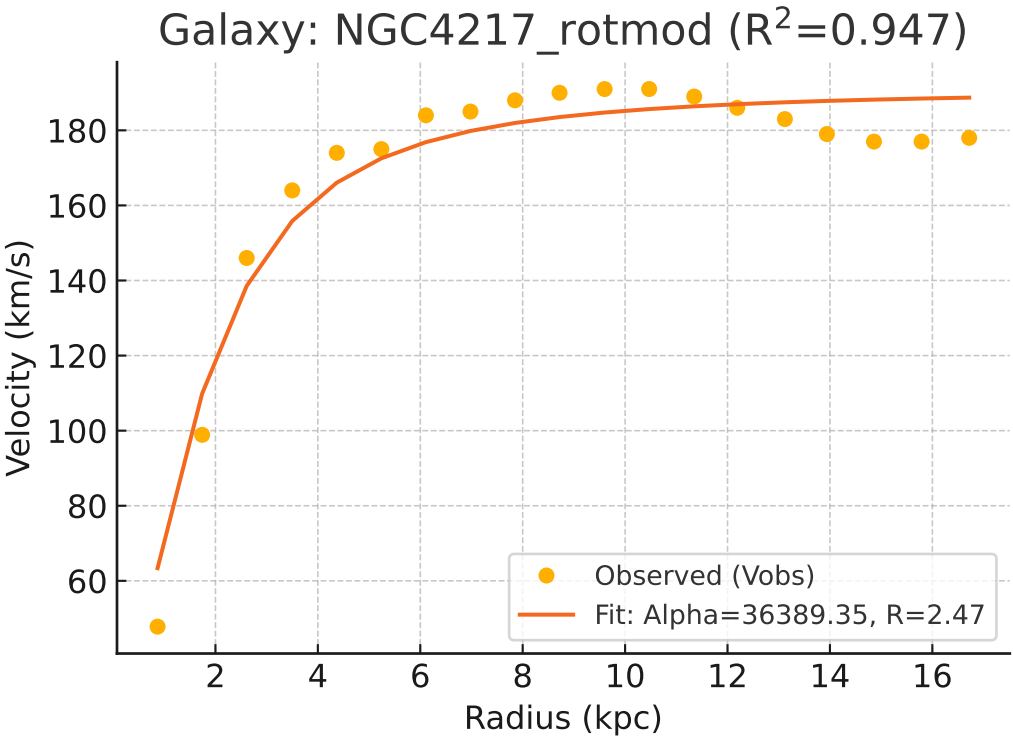

Galaxy: NGC4100_rotmod (R^2=0.331)
Velocity (km/s)
Radius (kpc)
120
130
140
150
160
170
180
190
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
Observed (Vobs)
Fit: Alpha=33034.98, R=2.09

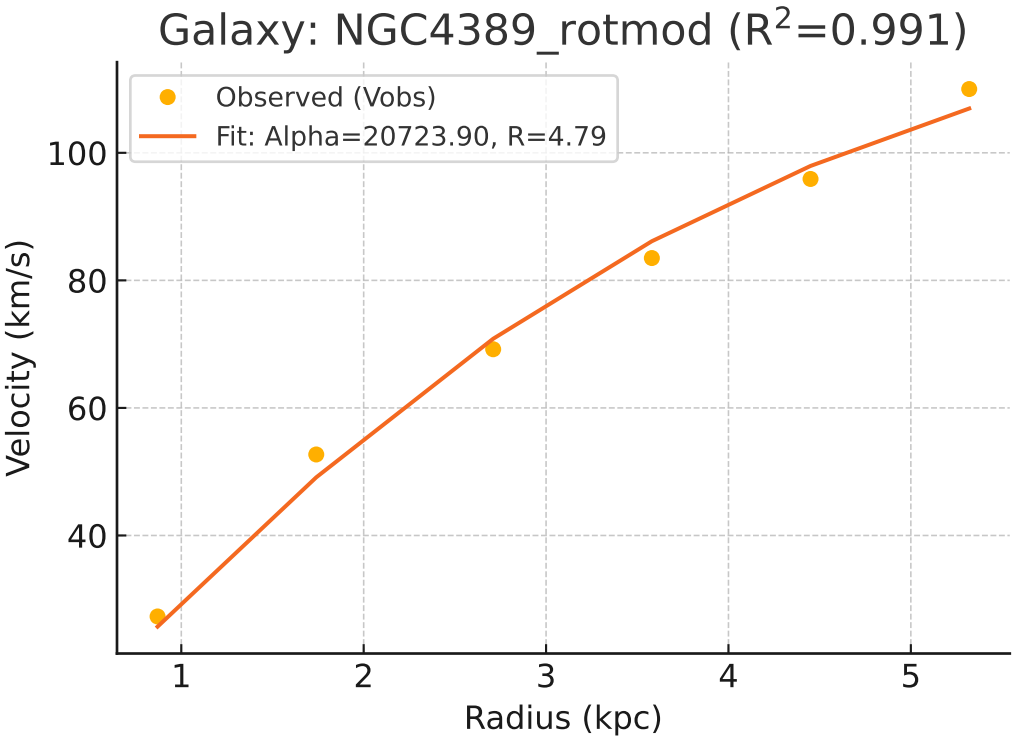

Galaxy: NGC4138_rotmod (R^2=-0.002)
Observed (Vobs)
Fit: Alpha=27421.81, R=0.10
Velocity (km/s)
Radius (kpc)
190
180
170
160
150
2
4
6
8
10
12
14
16
18

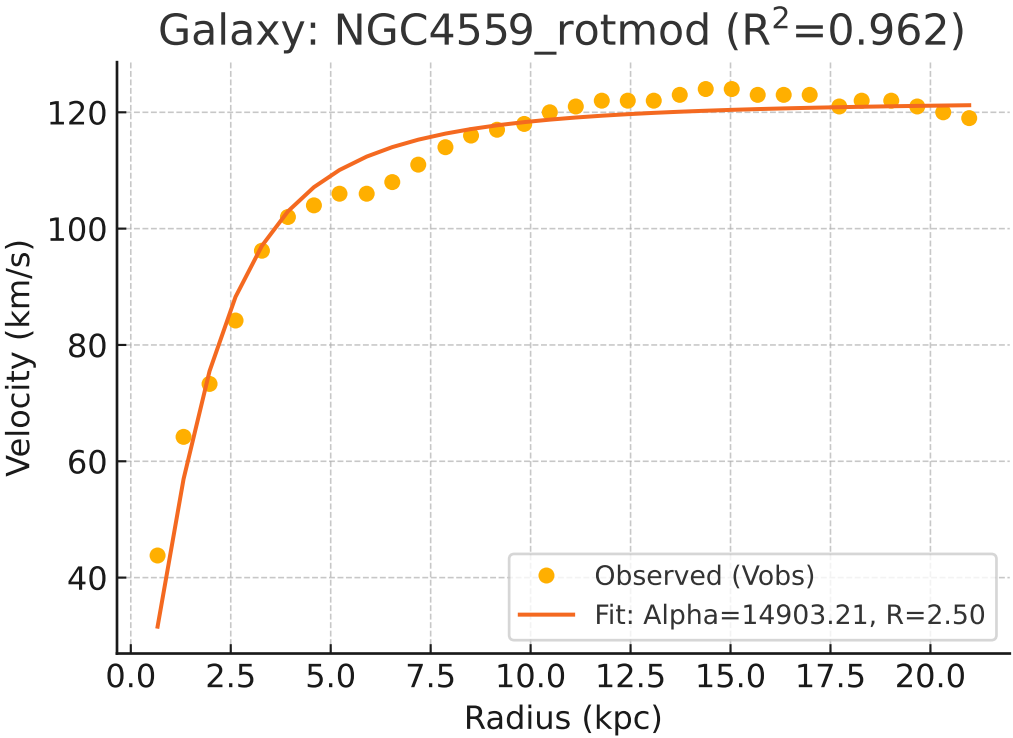

Galaxy: NGC4157_rotmod (R^2=0.814)
Velocity (km/s)
Radius (kpc)
100
120
140
160
180
200
5
10
15
20
25
30
Observed (Vobs)
Fit: Alpha=36475.67, R=2.41

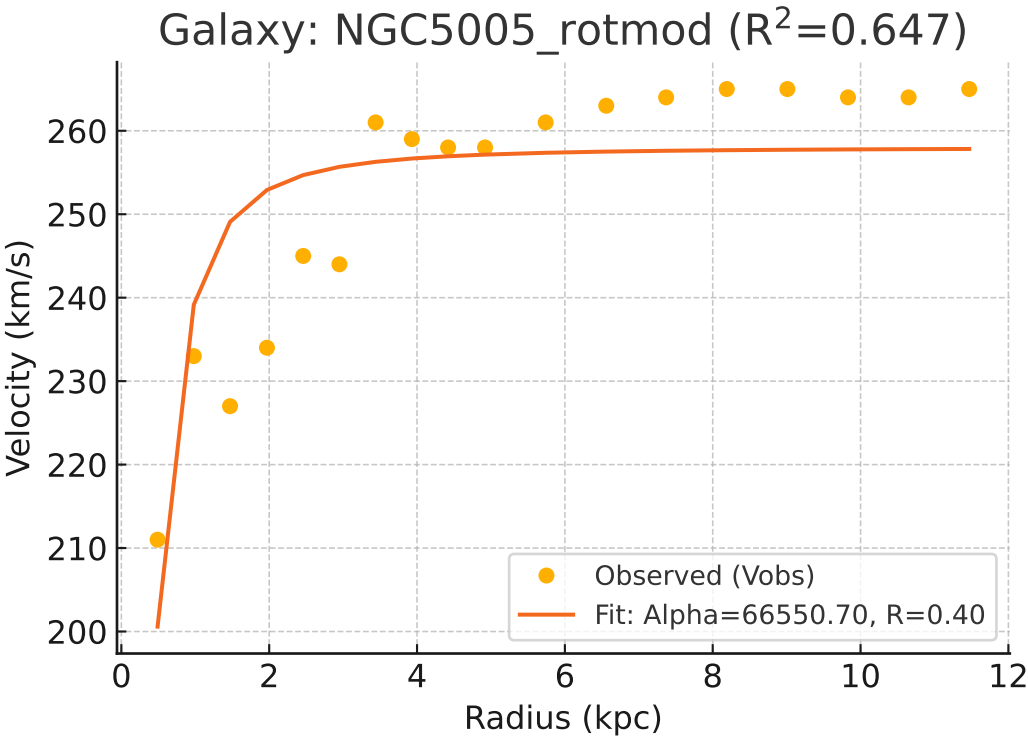

Galaxy: NGC4183_rotmod (R^2=0.956)
Velocity (km/s)
Radius (kpc)
40
50
60
70
80
90
100
110
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Observed (Vobs)
Fit: Alpha=12630.09, R=2.47

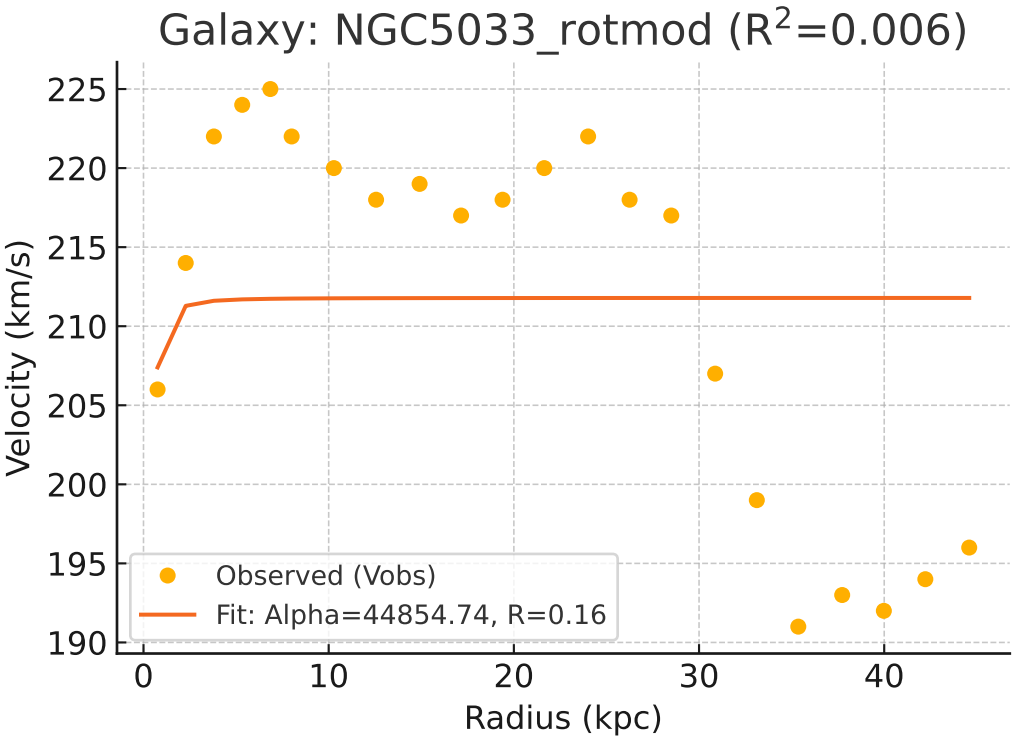

Galaxy: NGC4214_rotmod (R^2=0.656)
Velocity (km/s)
Radius (kpc)
80
75
70
65
60
55
50
0
1
2
3
4
5
Observed (Vobs)
Fit: Alpha=6060.64, R=0.24

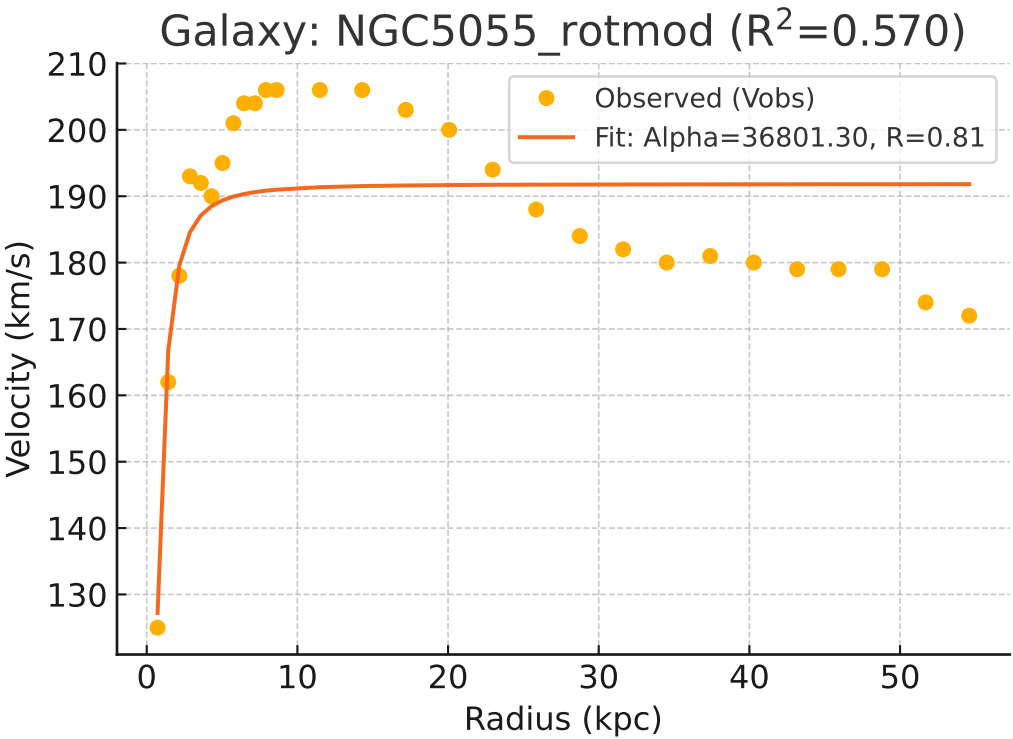

Galaxy: NGC4217_rotmod (R^2=0.947)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=36389.35, R=2.47

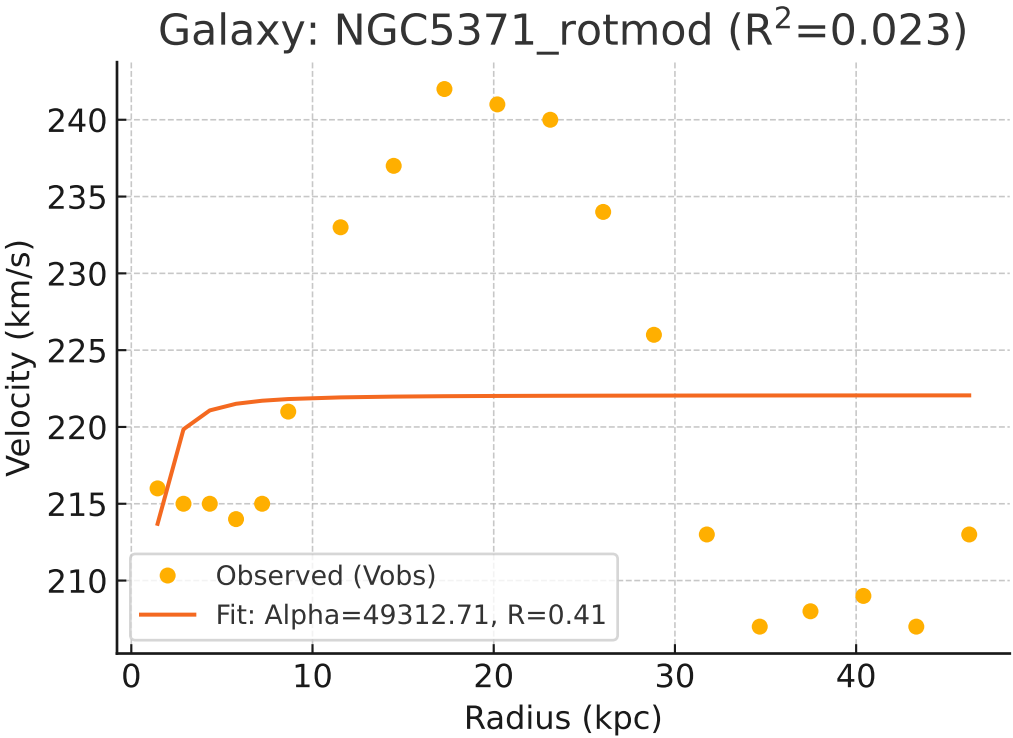

Galaxy: NGC4389_rotmod (R^2=0.991)
Observed (Vobs)
Fit: Alpha=20723.90, R=4.79
Velocity (km/s)
Radius (kpc)
100
80
60
40
1
2
3
4
5

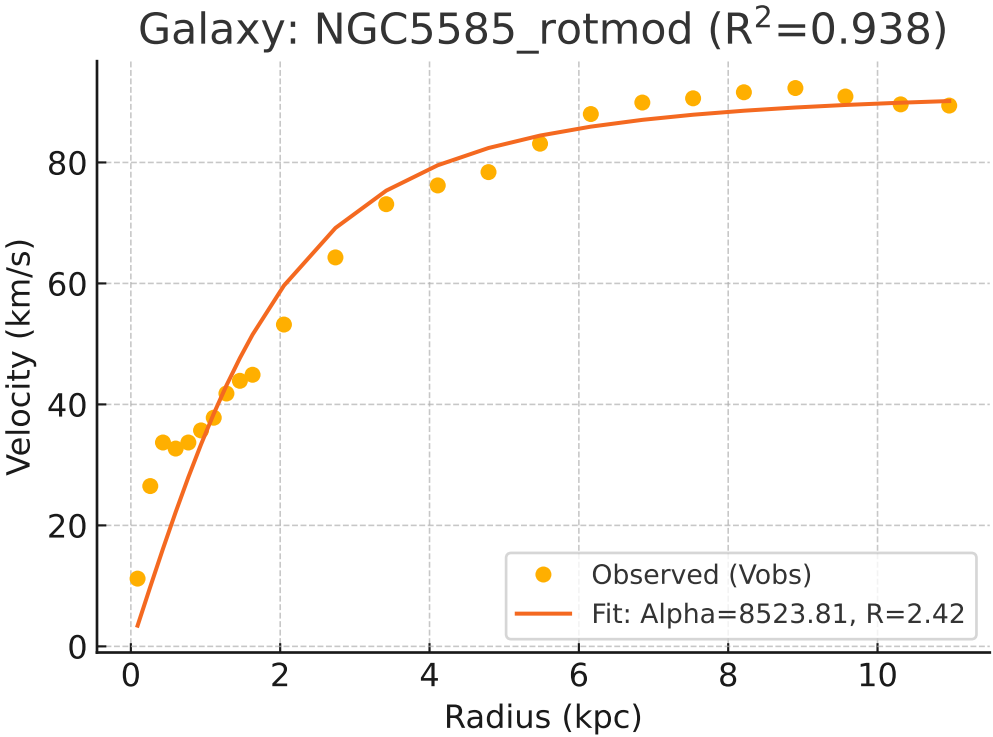

Galaxy: NGC4559_rotmod (R^2=0.962)
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Observed (Vobs)
Fit: Alpha=14903.21, R=2.50

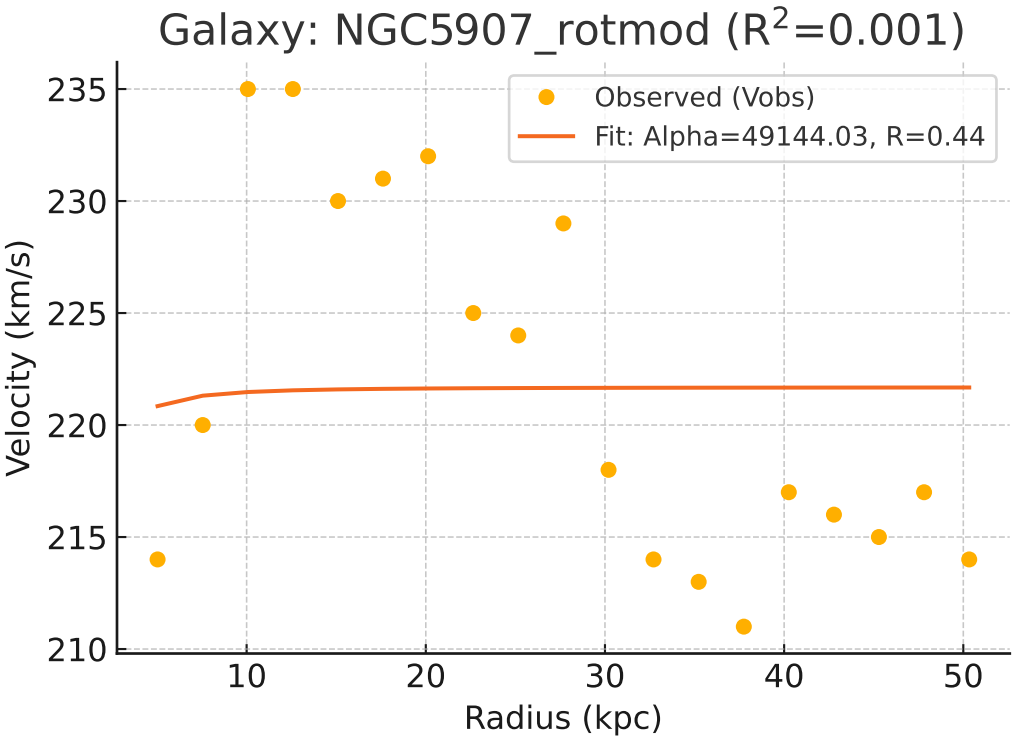

Galaxy: NGC5005_rotmod (R^2=0.647)
Velocity (km/s)
Radius (kpc)
200
210
220
230
240
250
260
0
2
4
6
8
10
12
Observed (Vobs)
Fit: Alpha=66550.70, R=0.40

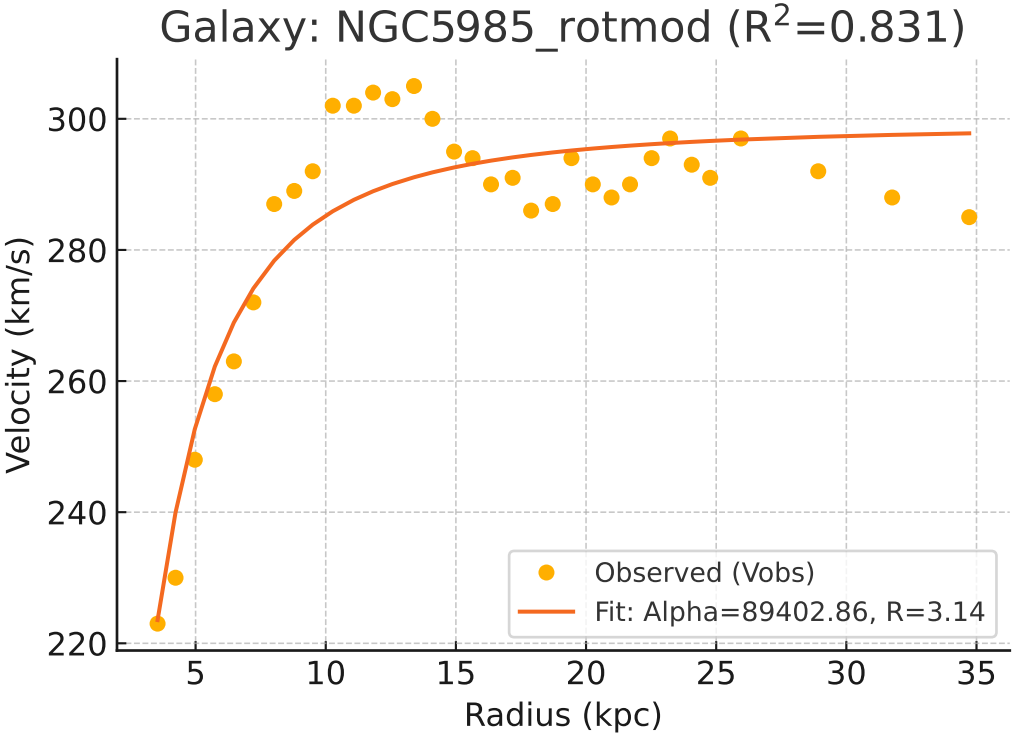

Galaxy: NGC5033_rotmod (R^2=0.006)
Velocity (km/s)
Radius (kpc)
225
220
215
210
205
200
195
190
0
10
20
30
40
Observed (Vobs)
Fit: Alpha=44854.74, R=0.16

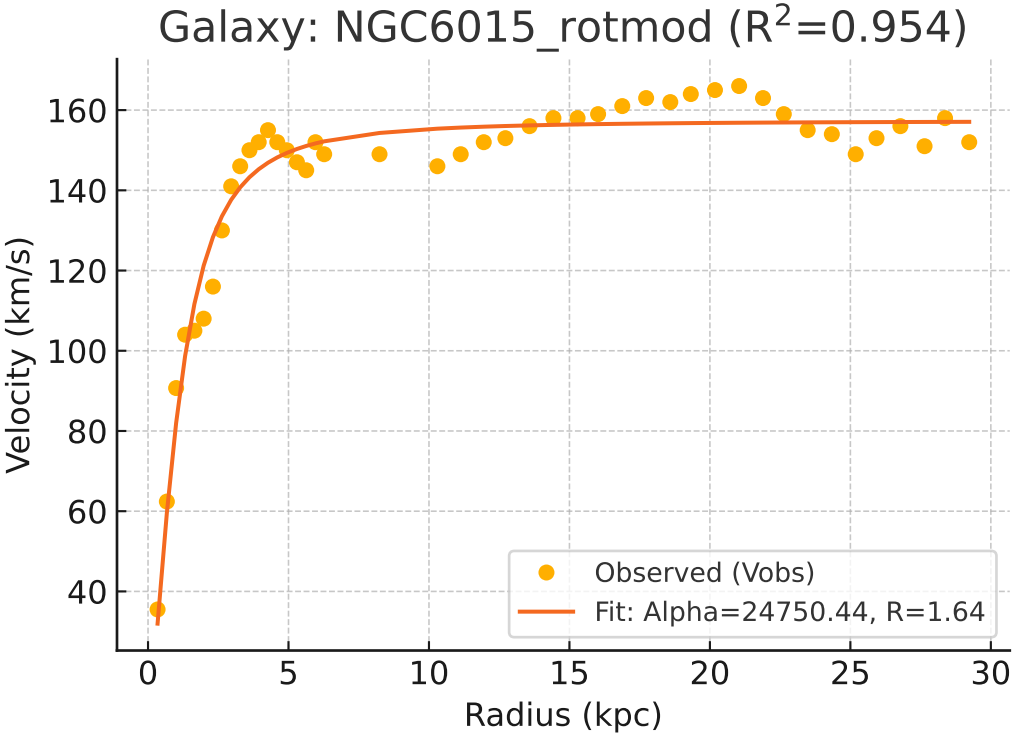

Galaxy: NGC5055_rotmod (R^2=0.570)
Observed (Vobs)
Fit: Alpha=36801.30, R=0.81
Velocity (km/s)
Radius (kpc)
210
200
190
180
170
160
150
140
130
0
10
20
30
40
50

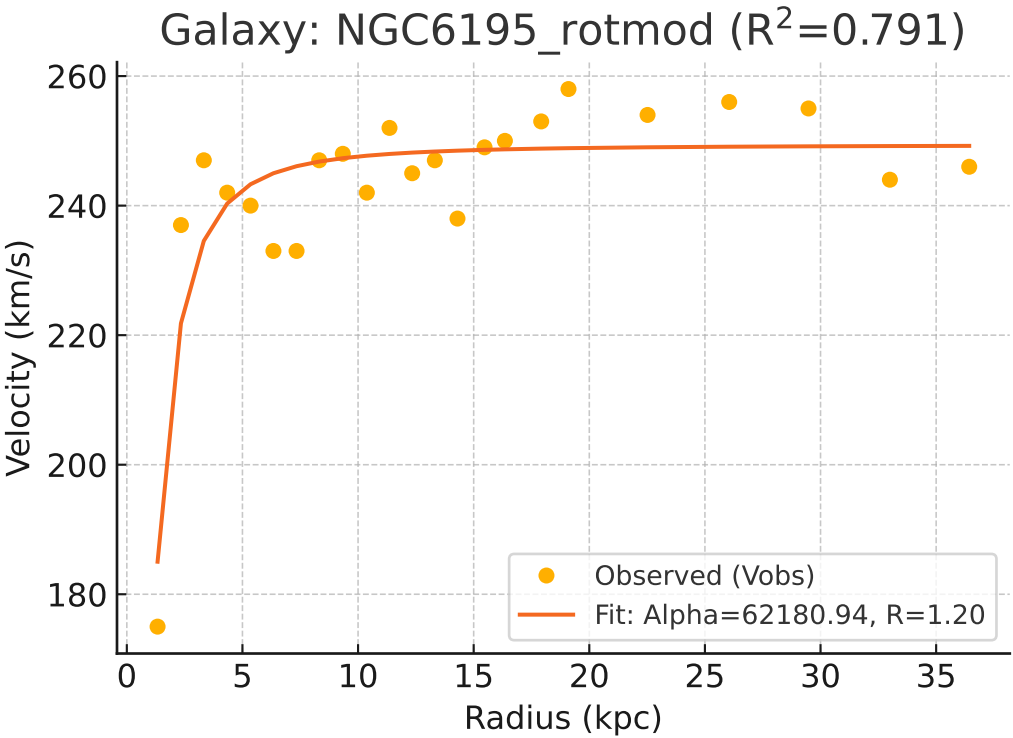

Galaxy: NGC5371_rotmod (R^2=0.023)
Velocity (km/s)
Radius (kpc)
240
235
230
225
220
215
210
0
10
20
30
40
Observed (Vobs)
Fit: Alpha=49312.71, R=0.41

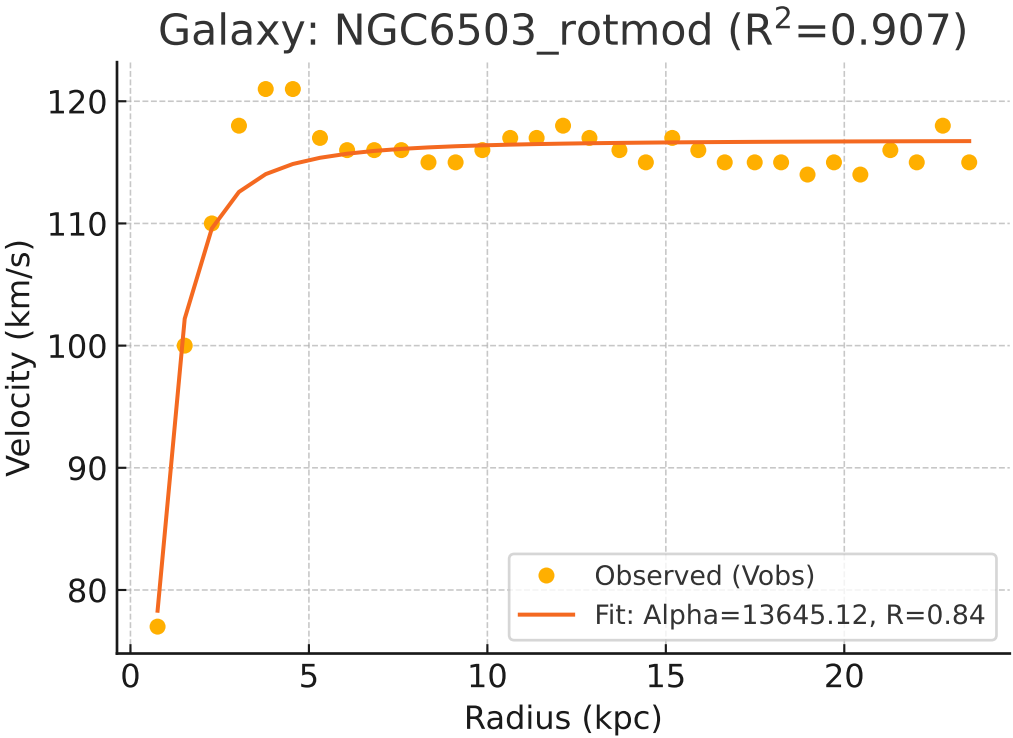

Galaxy: NGC5585_rotmod (R^2=0.938)
Velocity (km/s)
Radius (kpc)
0
20
40
60
80
0
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=8523.81, R=2.42

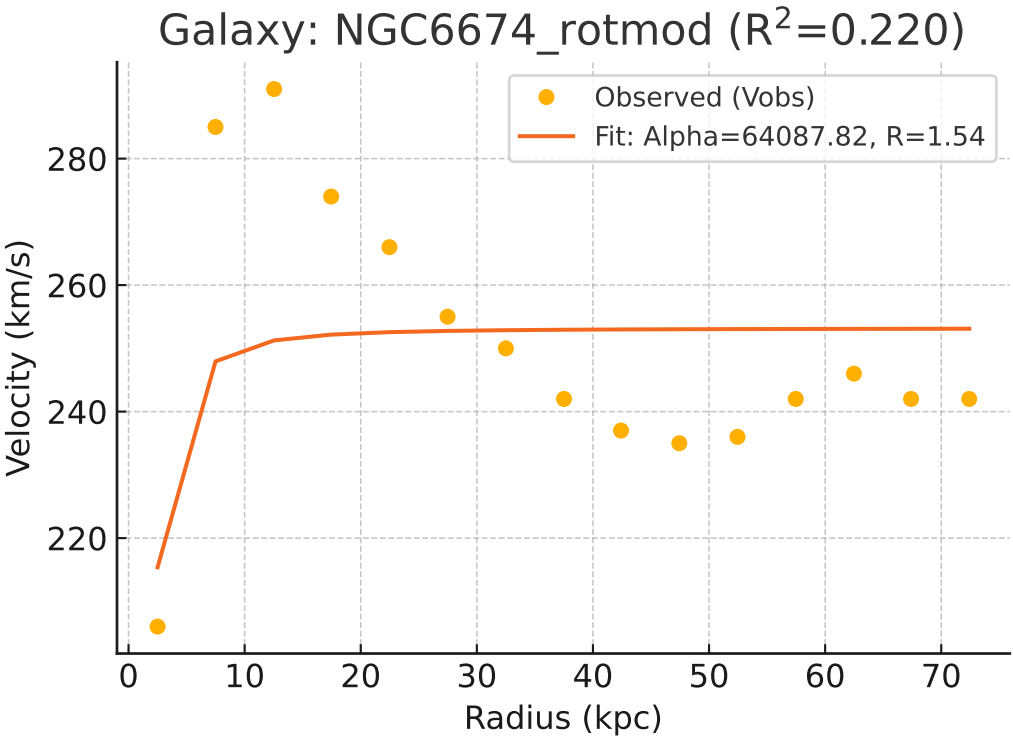

Galaxy: NGC5907_rotmod (R^2=0.001)
Observed (Vobs)
Fit: Alpha=49144.03, R=0.44
Velocity (km/s)
Radius (kpc)
235
230
225
220
215
210
10
20
30
40
50

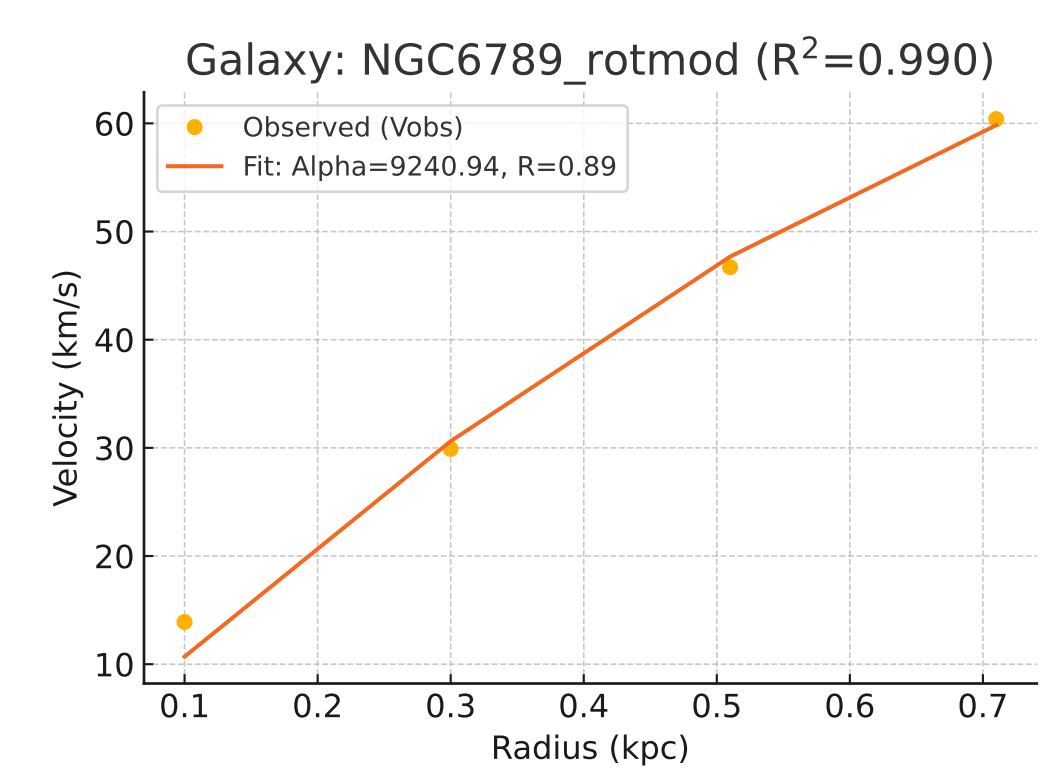

Galaxy: NGC5985_rotmod (R^2=0.831)
Velocity (km/s)
Radius (kpc)
300
280
260
240
220
5
10
15
20
25
30
35
Observed (Vobs)
Fit: Alpha=89402.86, R=3.14

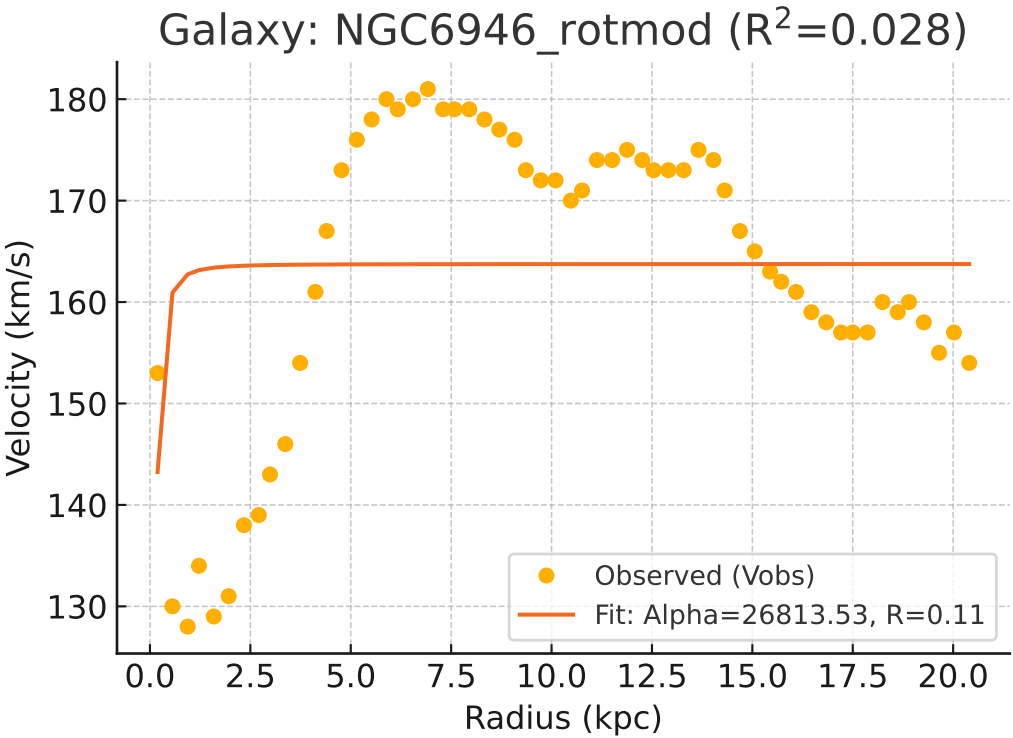

Galaxy: NGC6015_rotmod (R^2=0.954)
Velocity (km/s)
Radius (kpc)
160
140
120
100
80
60
40
0
5
10
15
20
25
30
Observed (Vobs)
Fit: Alpha=24750.44, R=1.64

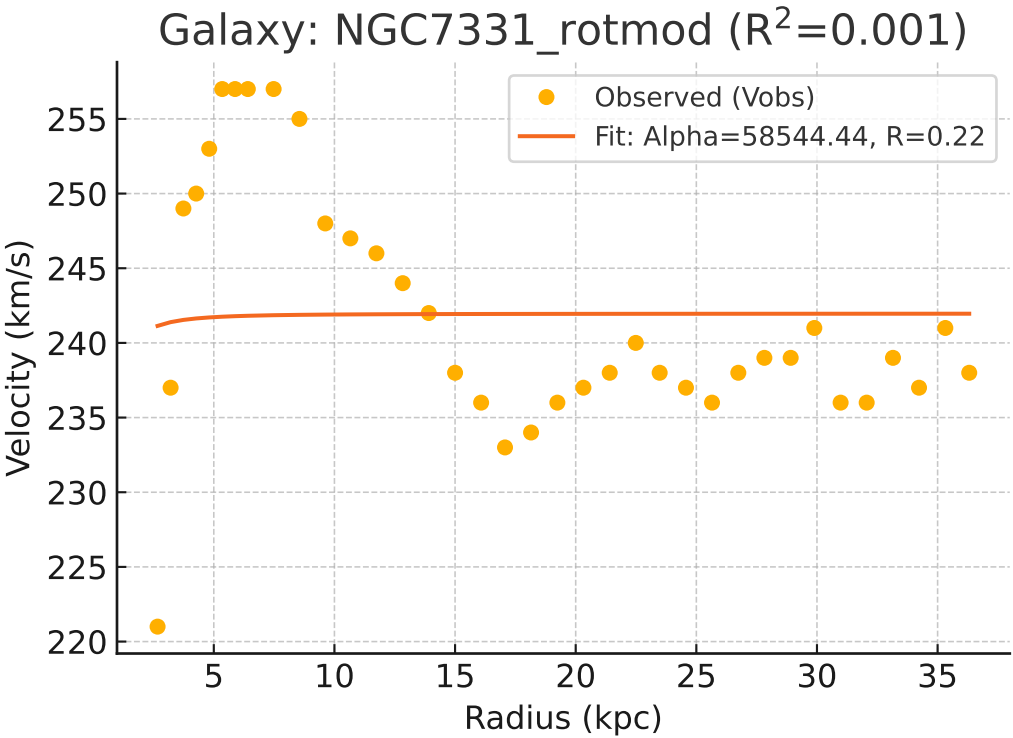

Galaxy: NGC6195_rotmod (R^2=0.791)
Velocity (km/s)
Radius (kpc)
260
240
220
200
180
0
5
10
15
20
25
30
35
Observed (Vobs)
Fit: Alpha=62180.94, R=1.20

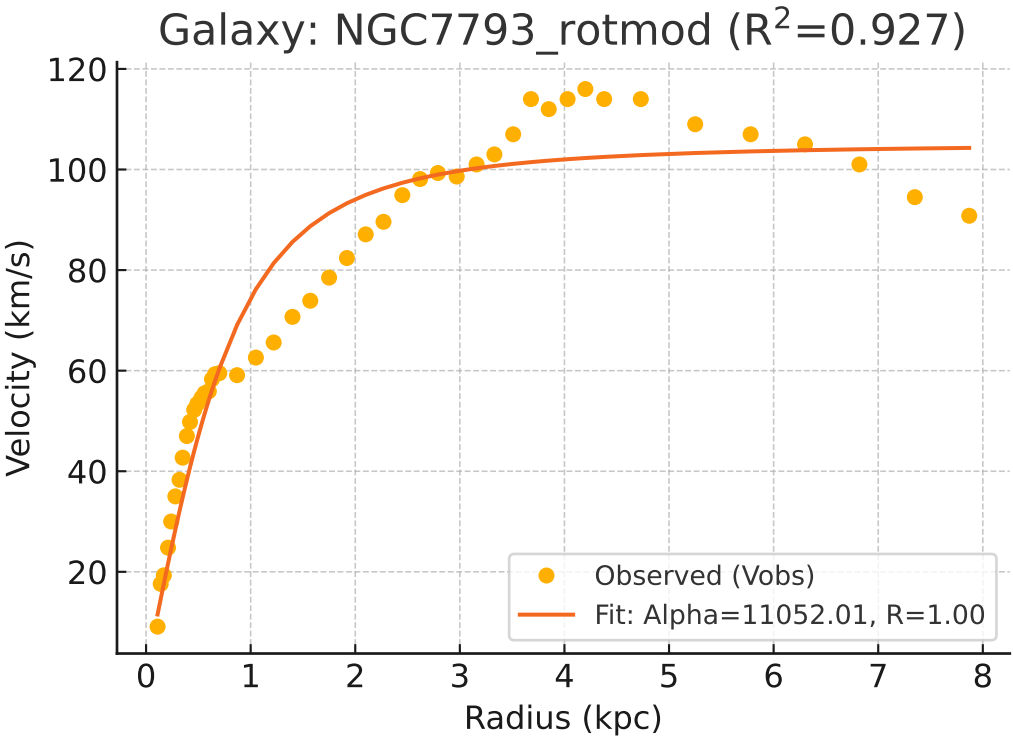

Galaxy: NGC6503_rotmod (R^2=0.907)
Velocity (km/s)
Radius (kpc)
120
110
100
90
80
0
5
10
15
20
Observed (Vobs)
Fit: Alpha=13645.12, R=0.84

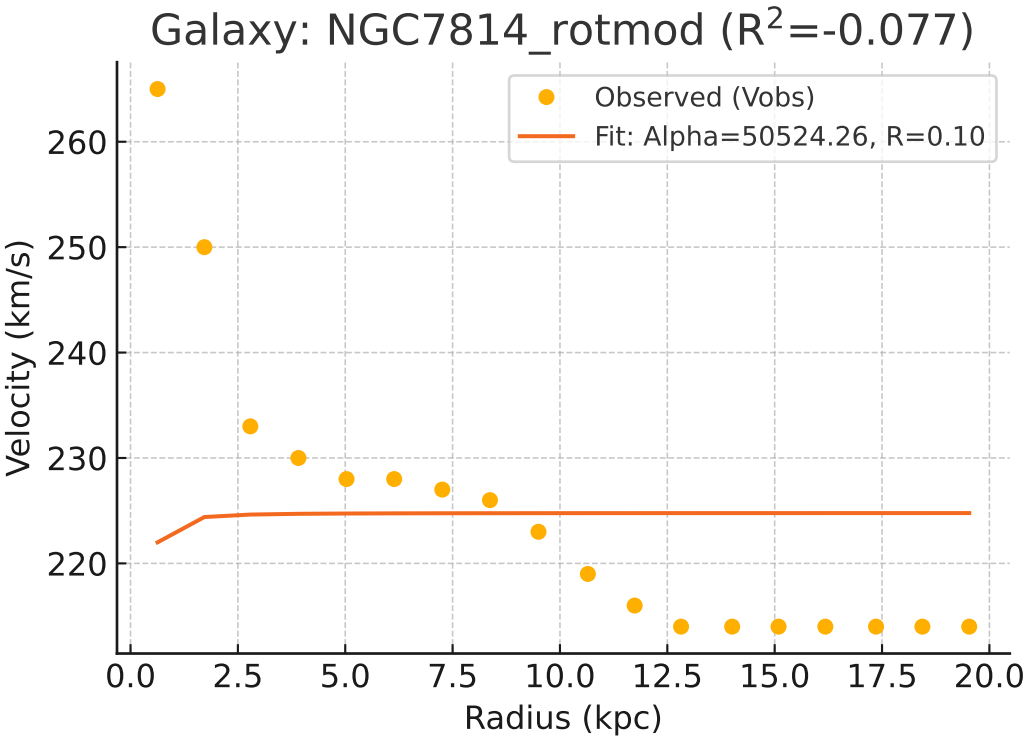

Galaxy: NGC6674_rotmod (R^2=0.220)
Observed (Vobs)
Fit: Alpha=64087.82, R=1.54
Velocity (km/s)
Radius (kpc)
220
240
260
280
0
10
20
30
40
50
60
70

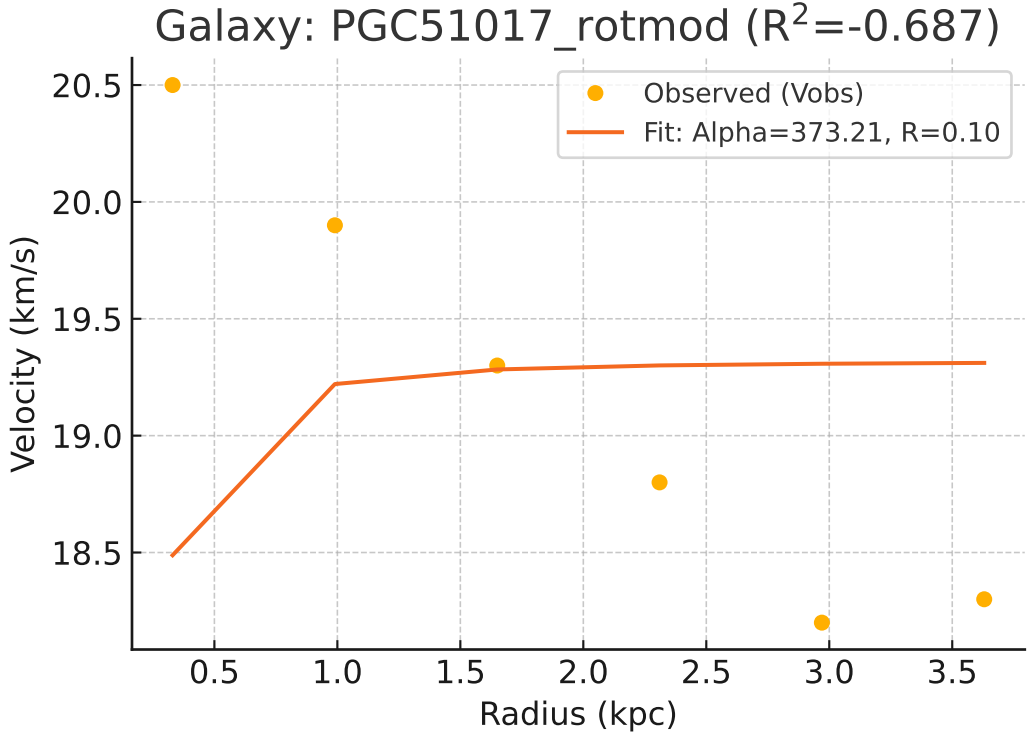

Galaxy: NGC6789_rotmod (R^2=0.990)
Observed (Vobs)
Fit: Alpha=9240.94, R=0.89
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
0.1
0.2
0.3
0.4
0.5
0.6
0.7

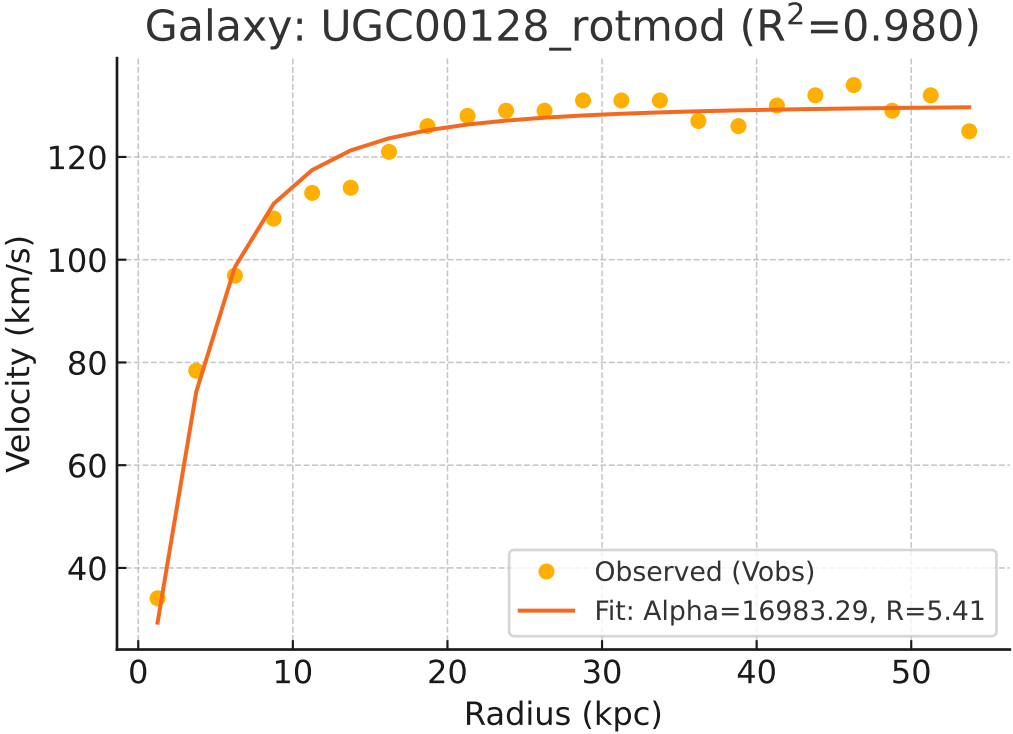

Galaxy: NGC6946_rotmod (R^2=0.028)
Velocity (km/s)
Radius (kpc)
180
170
160
150
140
130
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Observed (Vobs)
Fit: Alpha=26813.53, R=0.11

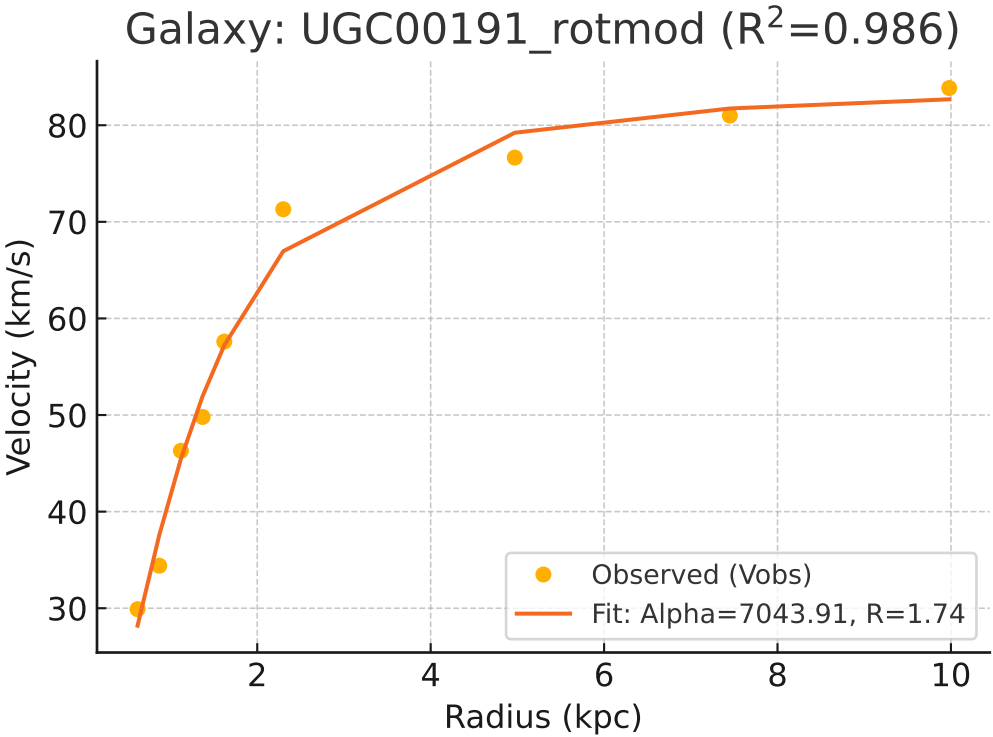

Galaxy: NGC7331_rotmod (R^2=0.001)
Observed (Vobs)
Fit: Alpha=58544.44, R=0.22
Velocity (km/s)
Radius (kpc)
220
225
230
235
240
245
250
255
5
10
15
20
25
30
35

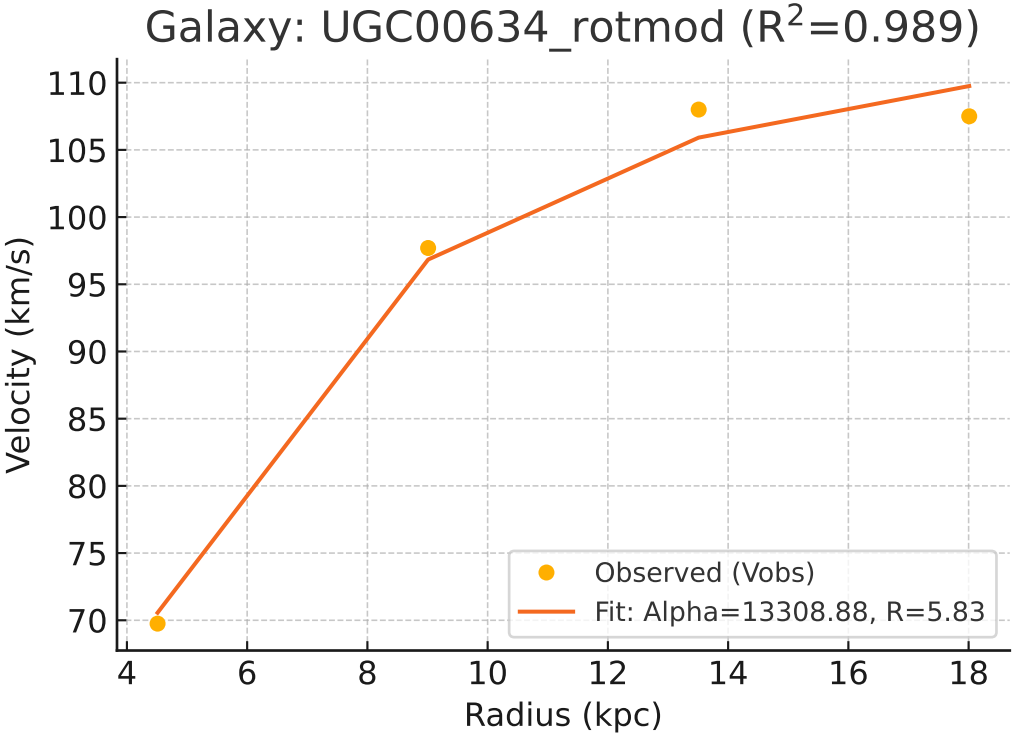

Galaxy: NGC7793_rotmod (R^2=0.927)
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=11052.01, R=1.00

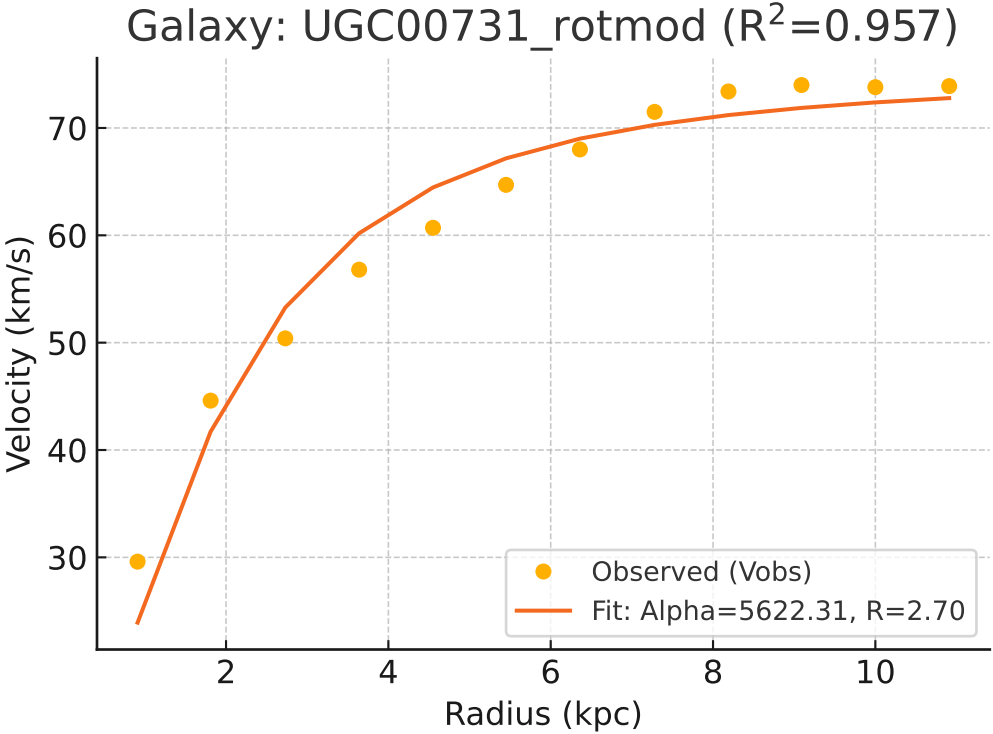

Galaxy: NGC7814_rotmod (R^2=-0.077)
Observed (Vobs)
Fit: Alpha=50524.26, R=0.10
Velocity (km/s)
260
250
240
230
220
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Radius (kpc)

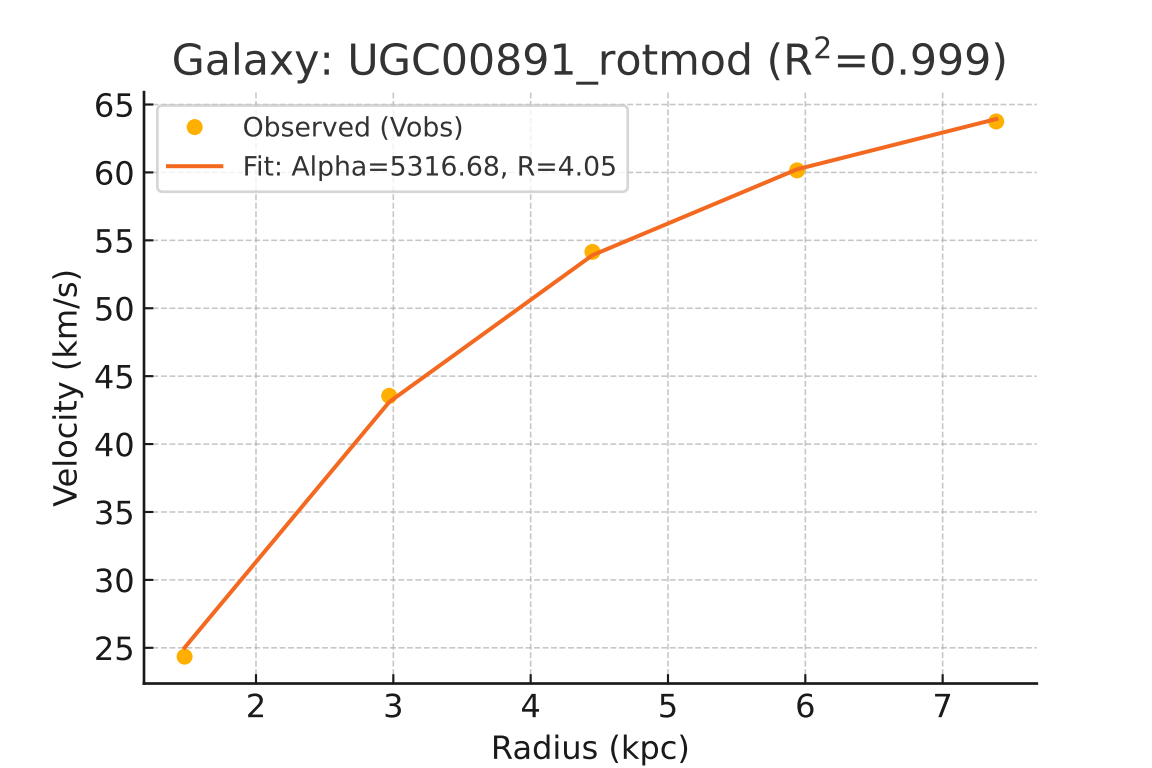

Galaxy: PGC51017_rotmod (R^2=-0.687)
Observed (Vobs)
Fit: Alpha=373.21, R=0.10
Velocity (km/s)
Radius (kpc)
20.5
20.0
19.5
19.0
18.5
0.5
1.0
1.5
2.0
2.5
3.0
3.5

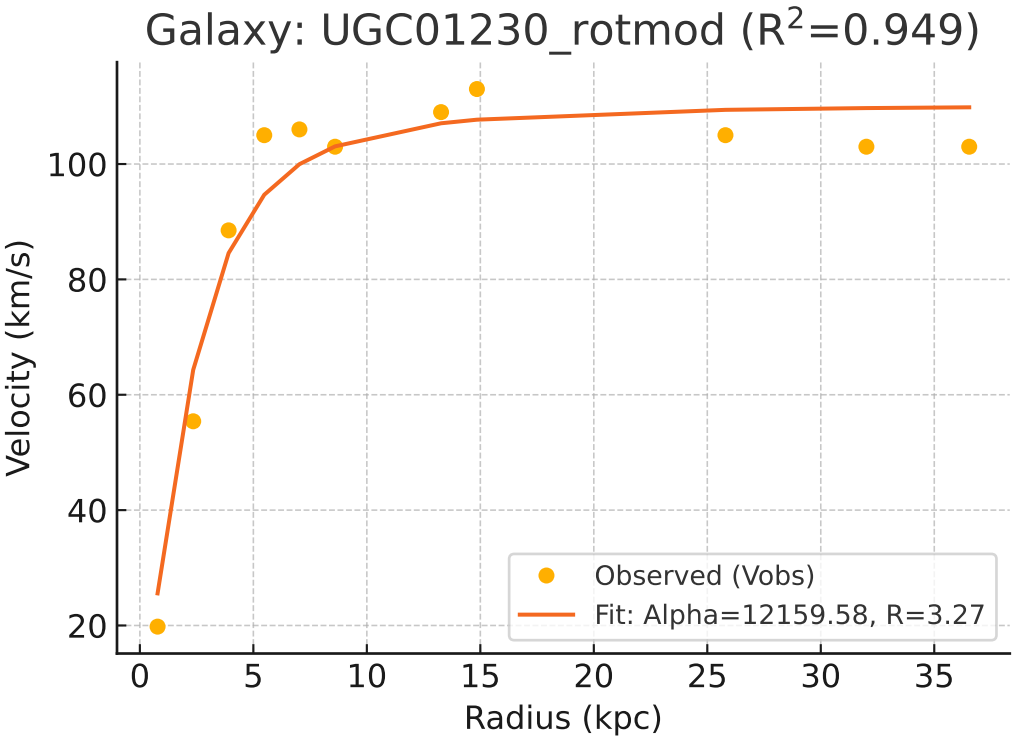

Galaxy: UGC00128_rotmod (R^2=0.980)
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
0
10
20
30
40
50
Observed (Vobs)
Fit: Alpha=16983.29, R=5.41

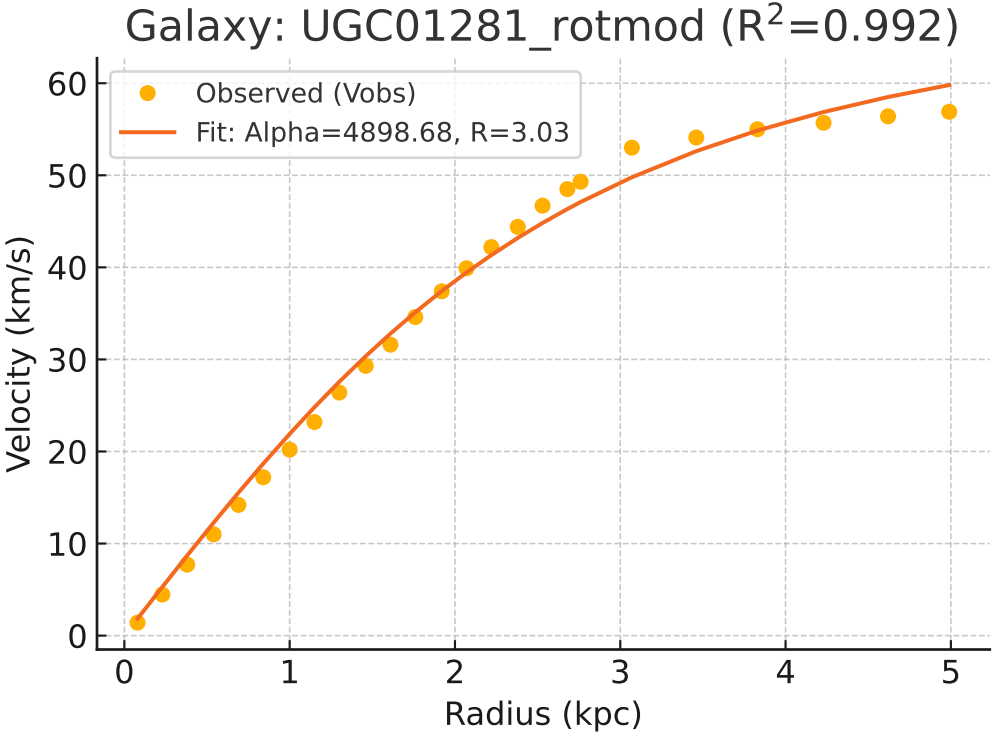

Galaxy: UGC00191_rotmod (R^2=0.986)
Velocity (km/s)
Radius (kpc)
30
40
50
60
70
80
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=7043.91, R=1.74

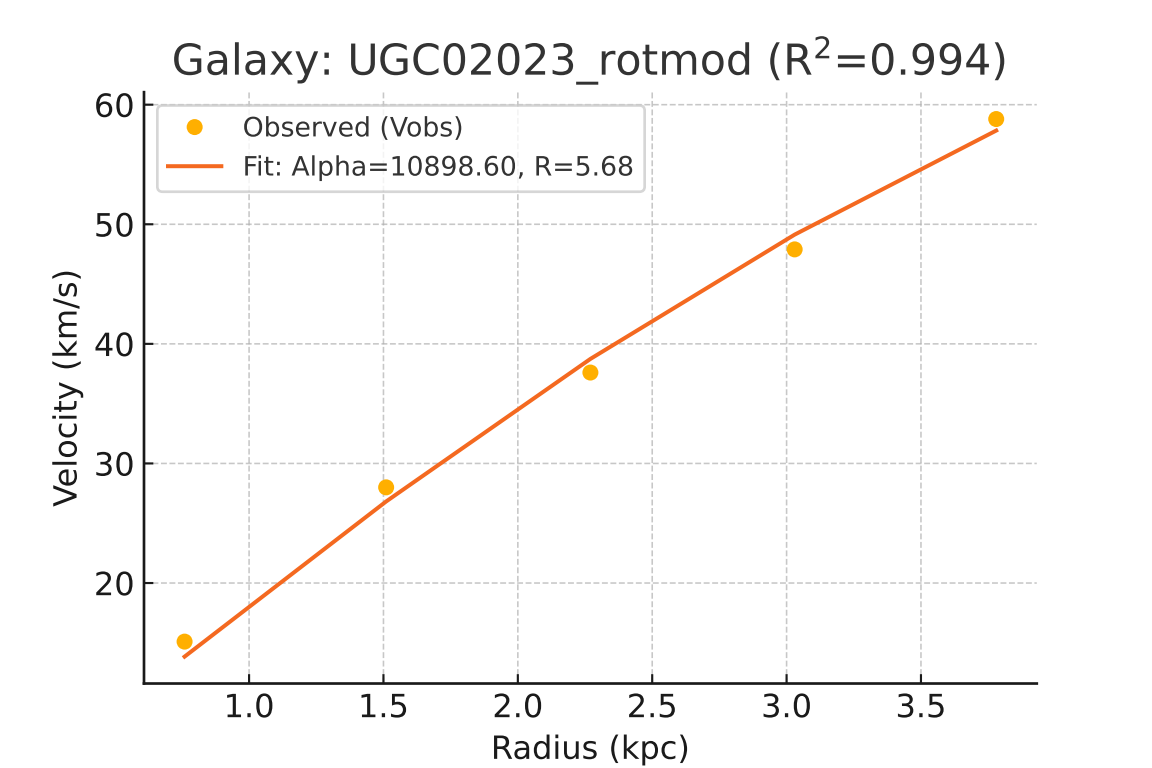

Galaxy: UGC00634_rotmod (R^2=0.989)
Velocity (km/s)
Radius (kpc)
110
105
100
95
90
85
80
75
70
4
6
8
10
12
14
16
18
Observed (Vobs)
Fit: Alpha=13308.88, R=5.83

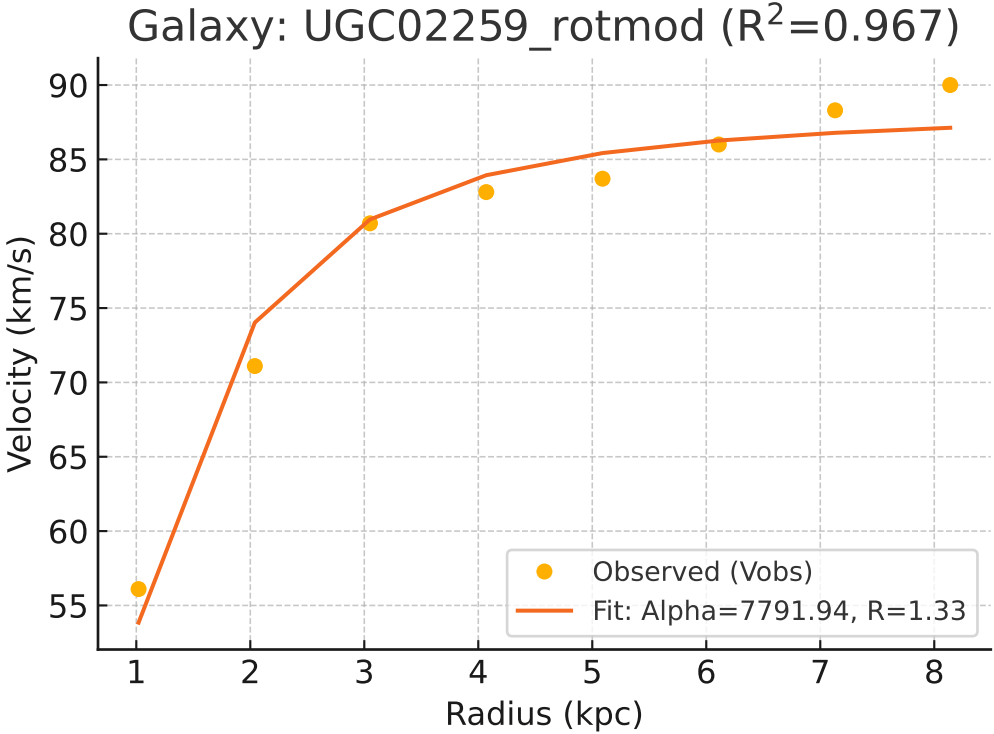

Galaxy: UGC00731_rotmod (R^2=0.957)
Velocity (km/s)
Radius (kpc)
70
60
50
40
30
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=5622.31, R=2.70

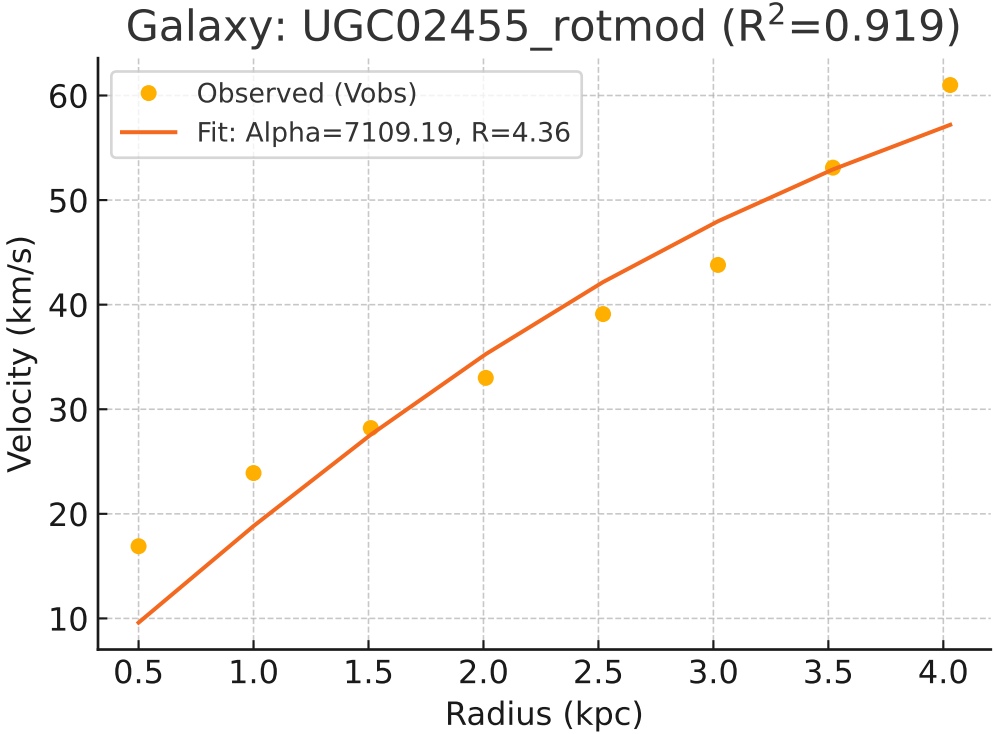

Galaxy: UGC00891_rotmod (R^2=0.999)
Observed (Vobs)
Fit: Alpha=5316.68, R=4.05
Velocity (km/s)
Radius (kpc)
65
60
55
50
45
40
35
30
25
2
3
4
5
6
7

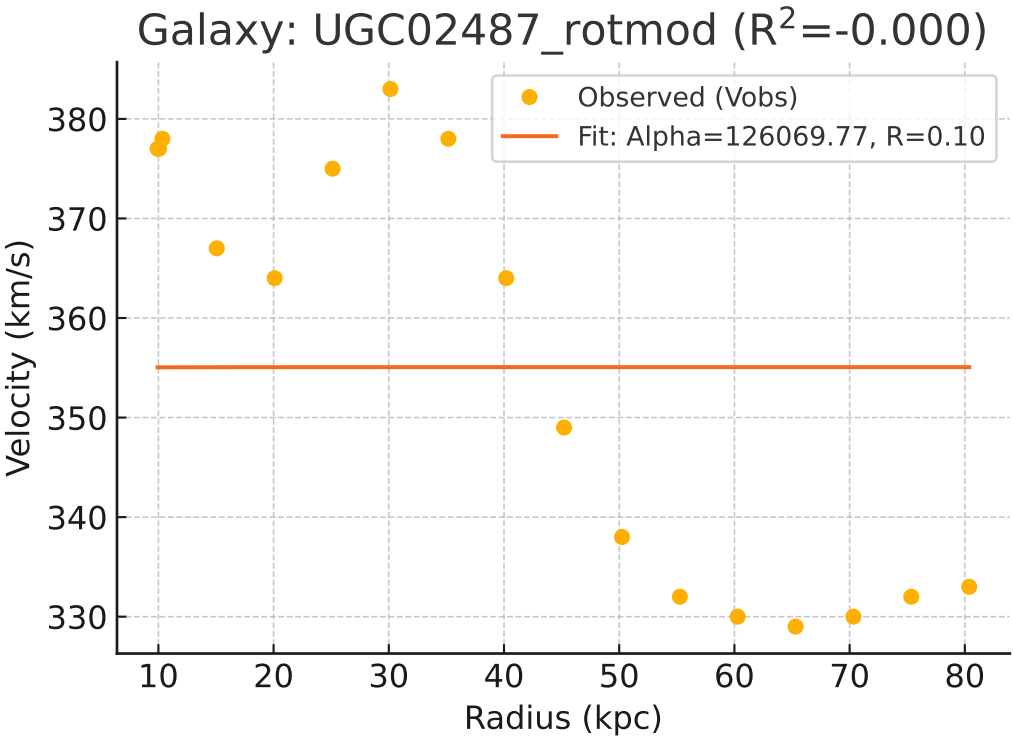

Galaxy: UGC01230_rotmod (R^2=0.949)
Velocity (km/s)
Radius (kpc)
20
40
60
80
100
0
5
10
15
20
25
30
35
Observed (Vobs)
Fit: Alpha=12159.58, R=3.27

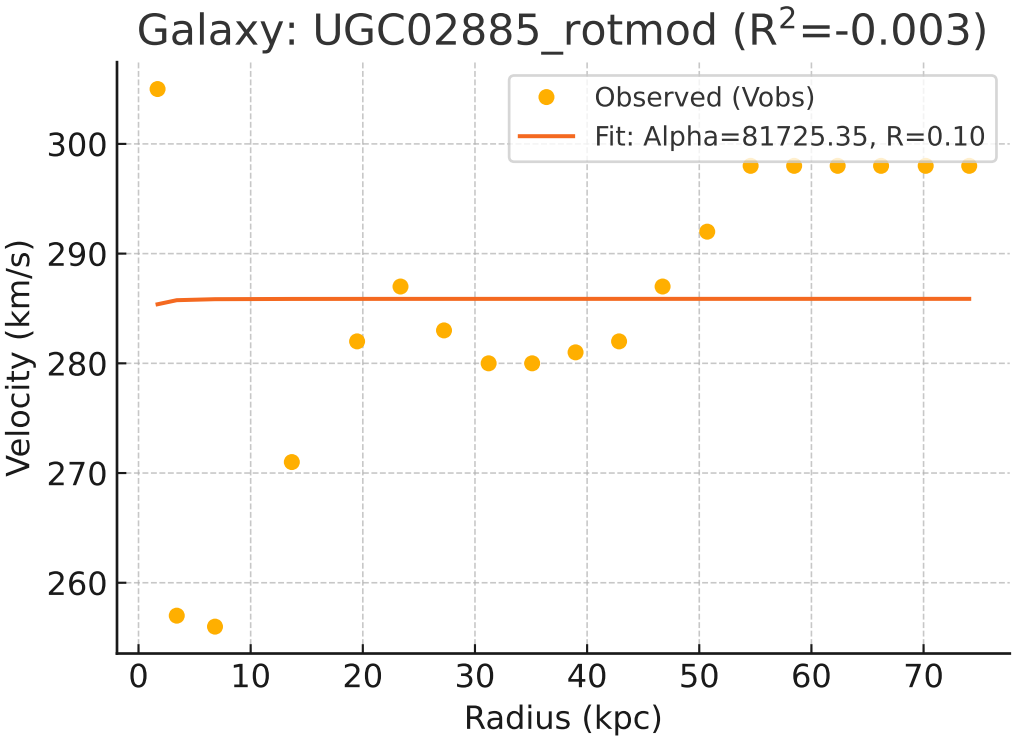

Galaxy: UGC01281_rotmod (R^2=0.992)
Observed (Vobs)
Fit: Alpha=4898.68, R=3.03
Velocity (km/s)
Radius (kpc)
0
10
20
30
40
50
60
0
1
2
3
4
5

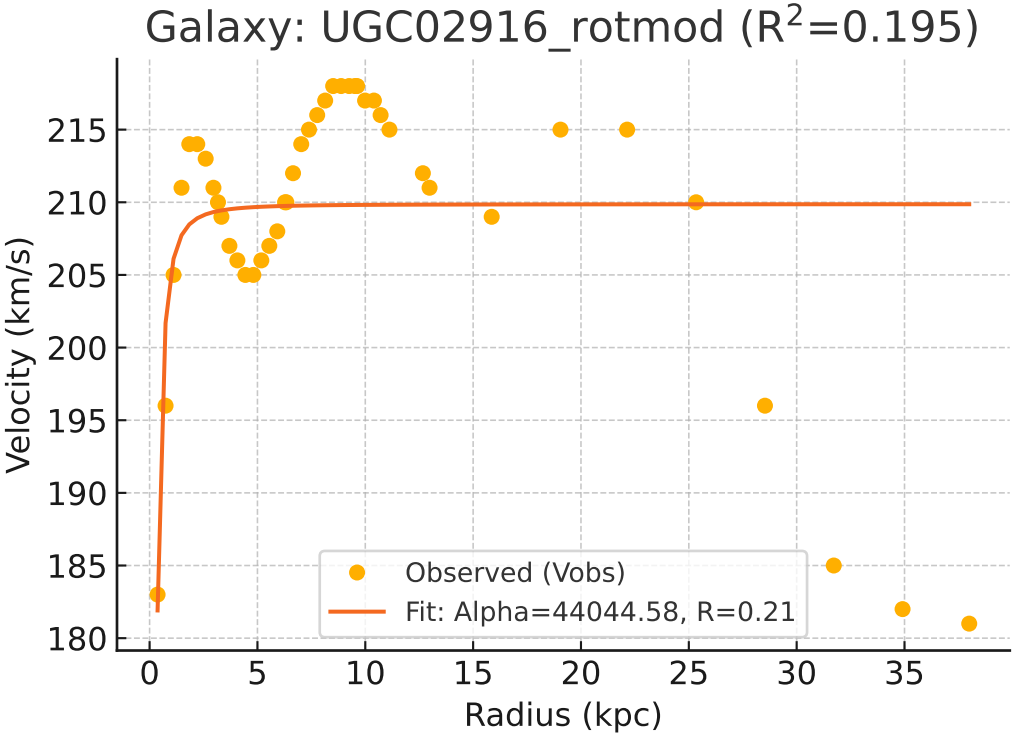

Galaxy: UGC02023_rotmod (R^2=0.994)
Observed (Vobs)
Fit: Alpha=10898.60, R=5.68
Velocity (km/s)
Radius (kpc)
60
50
40
30
20
1.0
1.5
2.0
2.5
3.0
3.5

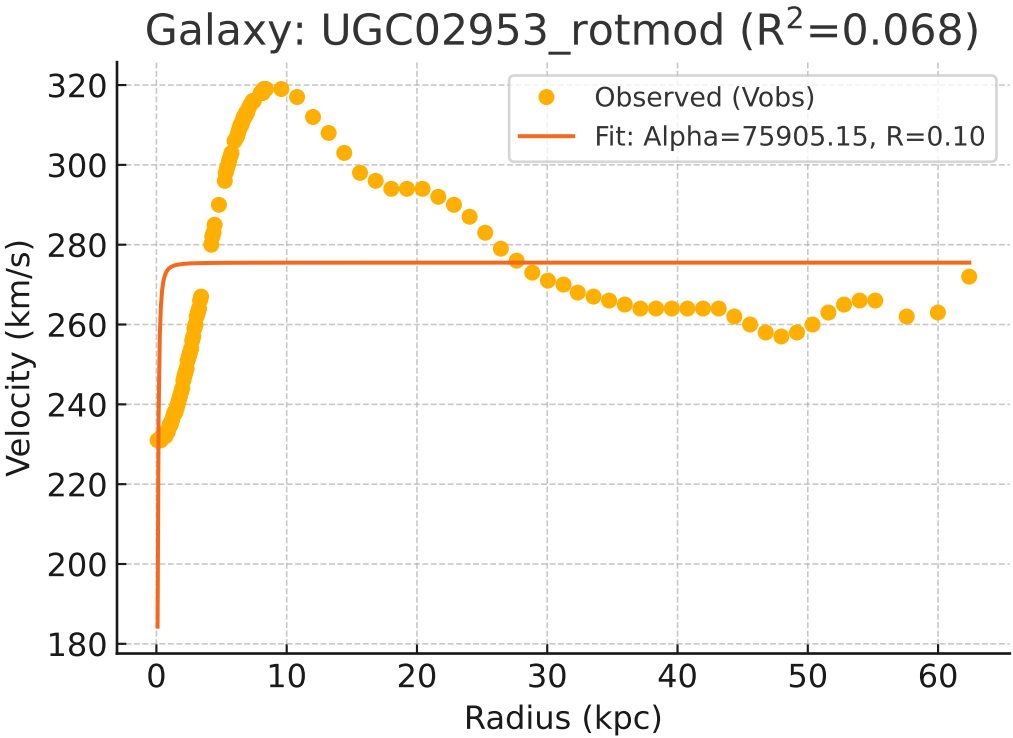

Galaxy: UGC02259_rotmod (R^2=0.967)
Velocity (km/s)
Radius (kpc)
90
85
80
75
70
65
60
55
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=7791.94, R=1.33

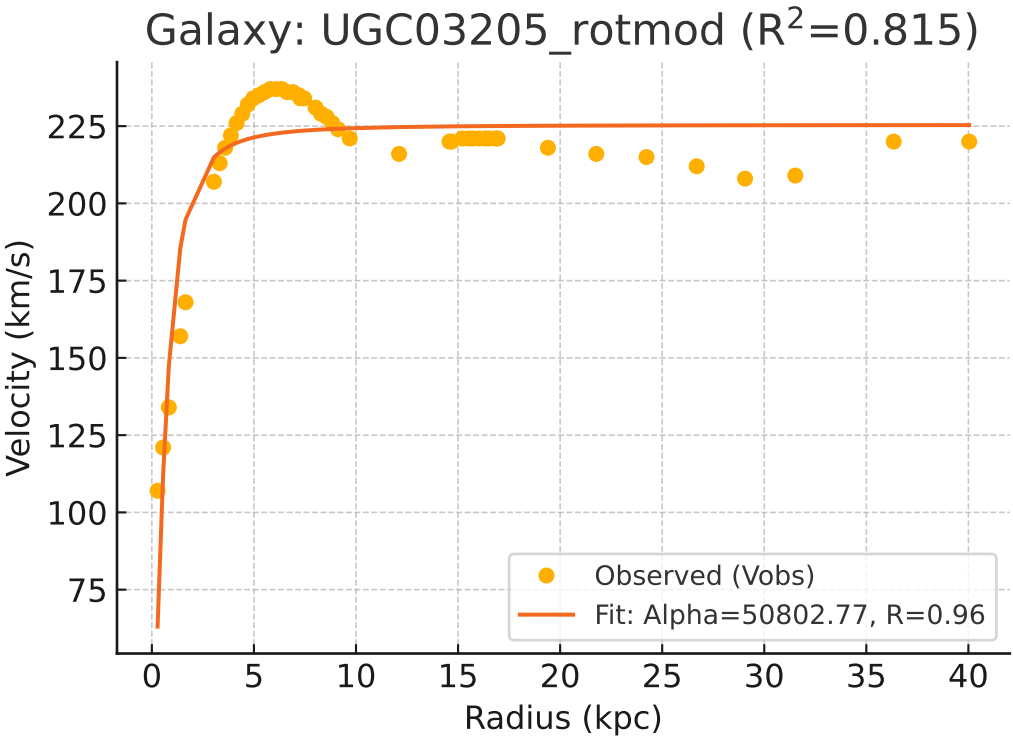

Galaxy: UGC02455_rotmod (R^2=0.919)
Observed (Vobs)
Fit: Alpha=7109.19, R=4.36
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

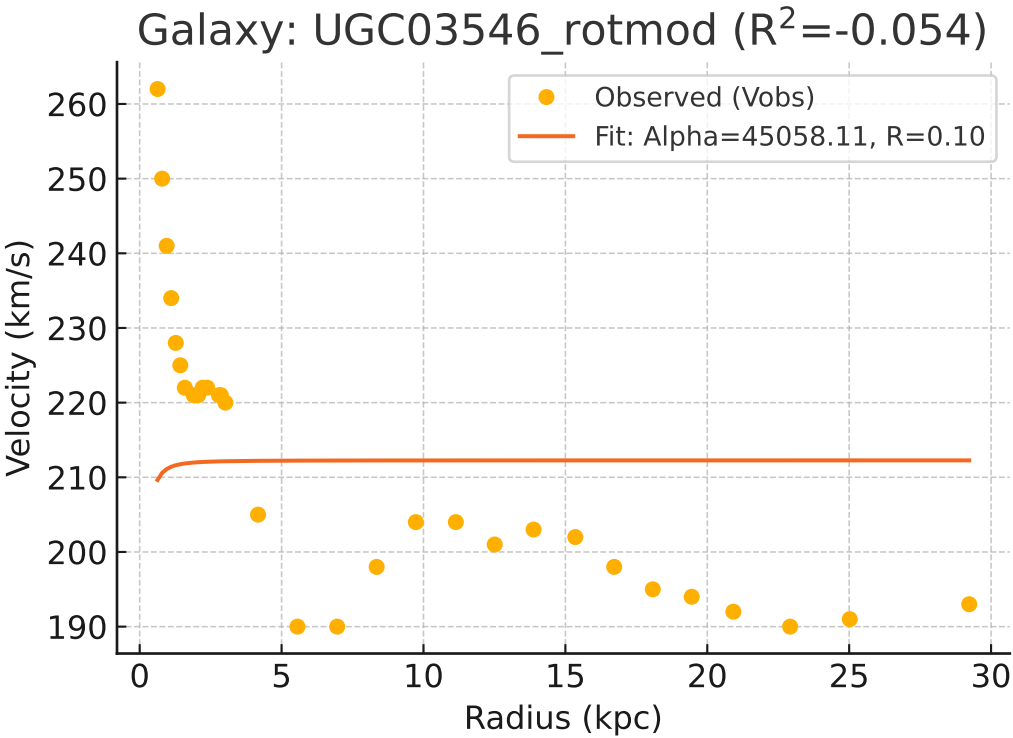

Galaxy: UGC02487_rotmod (R^2=-0.000)
Observed (Vobs)
Fit: Alpha=126069.77, R=0.10
Velocity (km/s)
Radius (kpc)
380
370
360
350
340
330
10
20
30
40
50
60
70
80

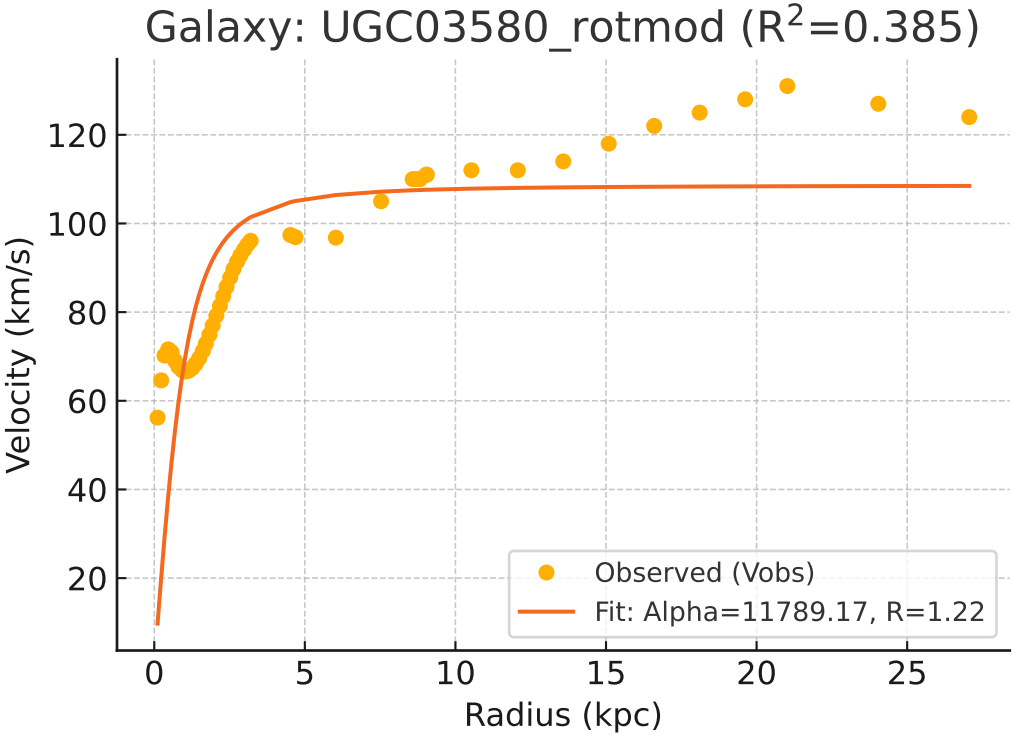

Galaxy: UGC02885_rotmod (R^2=-0.003)
Observed (Vobs)
Fit: Alpha=81725.35, R=0.10
Velocity (km/s)
Radius (kpc)
300
290
280
270
260
0
10
20
30
40
50
60
70

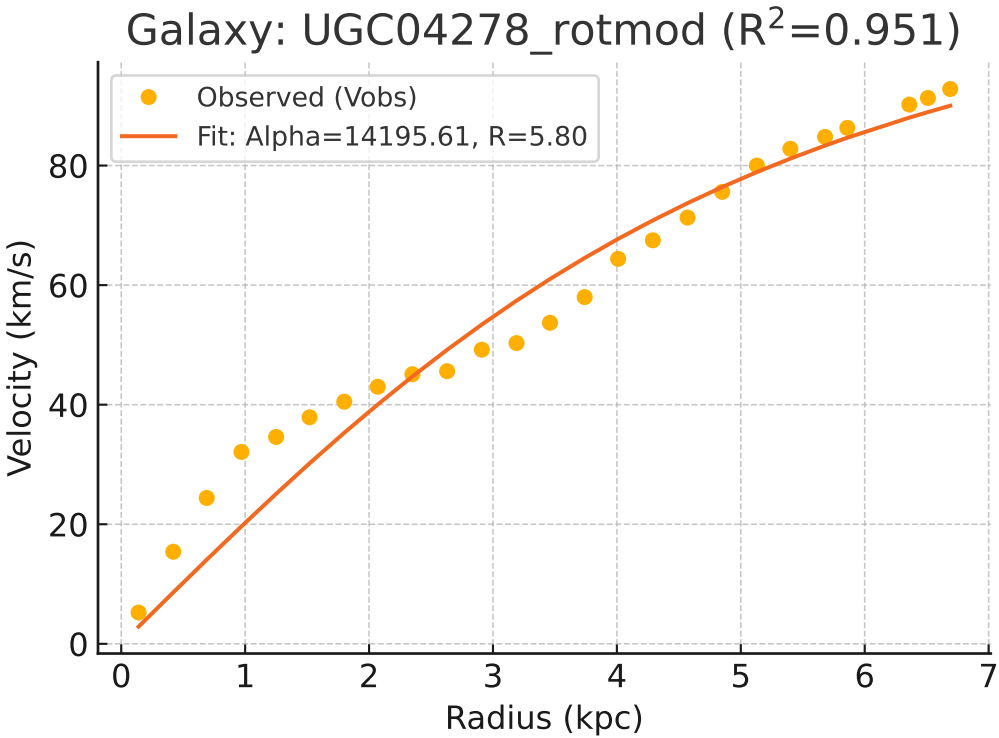

Galaxy: UGC02916_rotmod (R^2=0.195)
Velocity (km/s)
Radius (kpc)
Observed (Vobs)
Fit: Alpha=44044.58, R=0.21
180
185
190
195
200
205
210
215
0
5
10
15
20
25
30
35

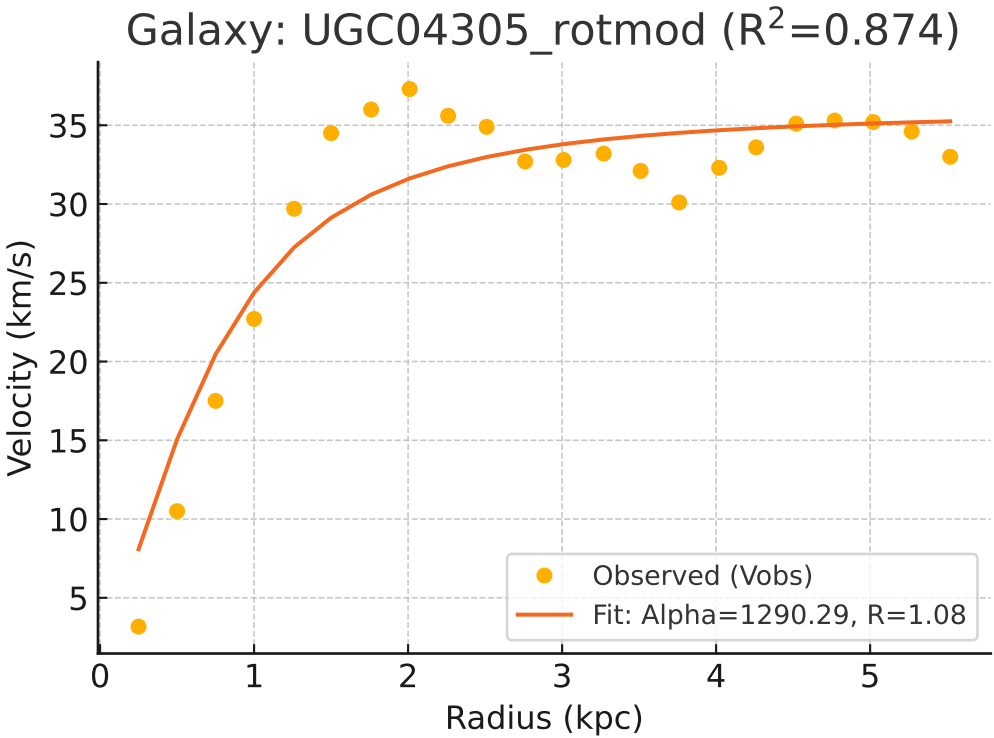

Galaxy: UGC02953_rotmod (R^2=0.068)
Observed (Vobs)
Fit: Alpha=75905.15, R=0.10
Velocity (km/s)
Radius (kpc)
320
300
280
260
240
220
200
180
0
10
20
30
40
50
60

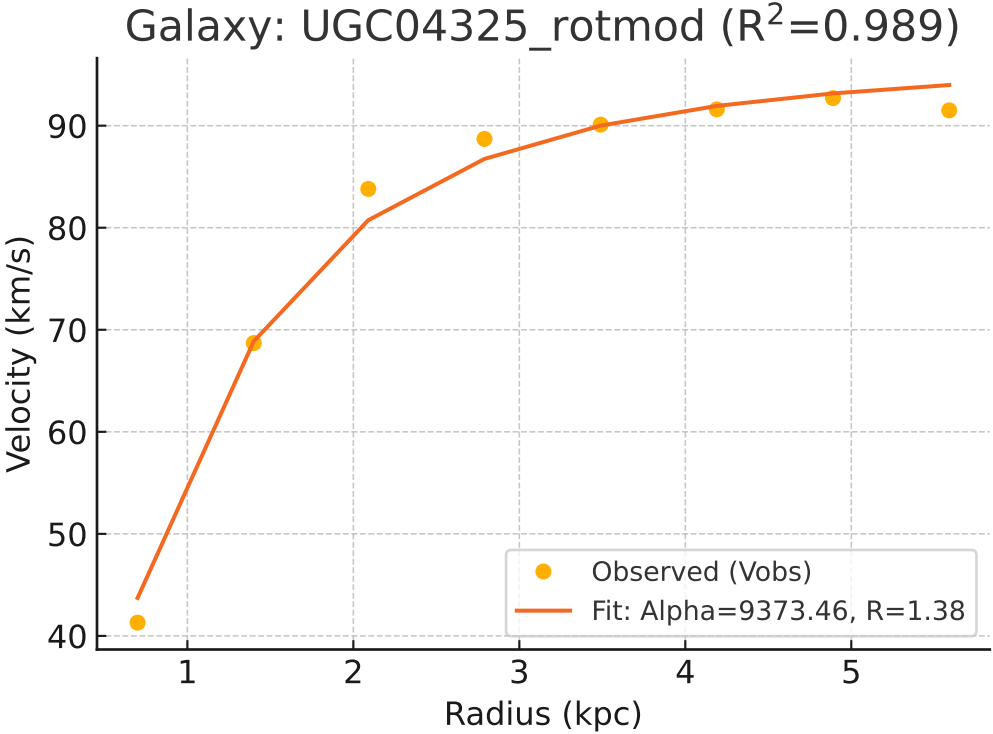

Galaxy: UGC03205_rotmod (R^2=0.815)
Velocity (km/s)
Radius (kpc)
225
200
175
150
125
100
75
0
5
10
15
20
25
30
35
40
Observed (Vobs)
Fit: Alpha=50802.77, R=0.96

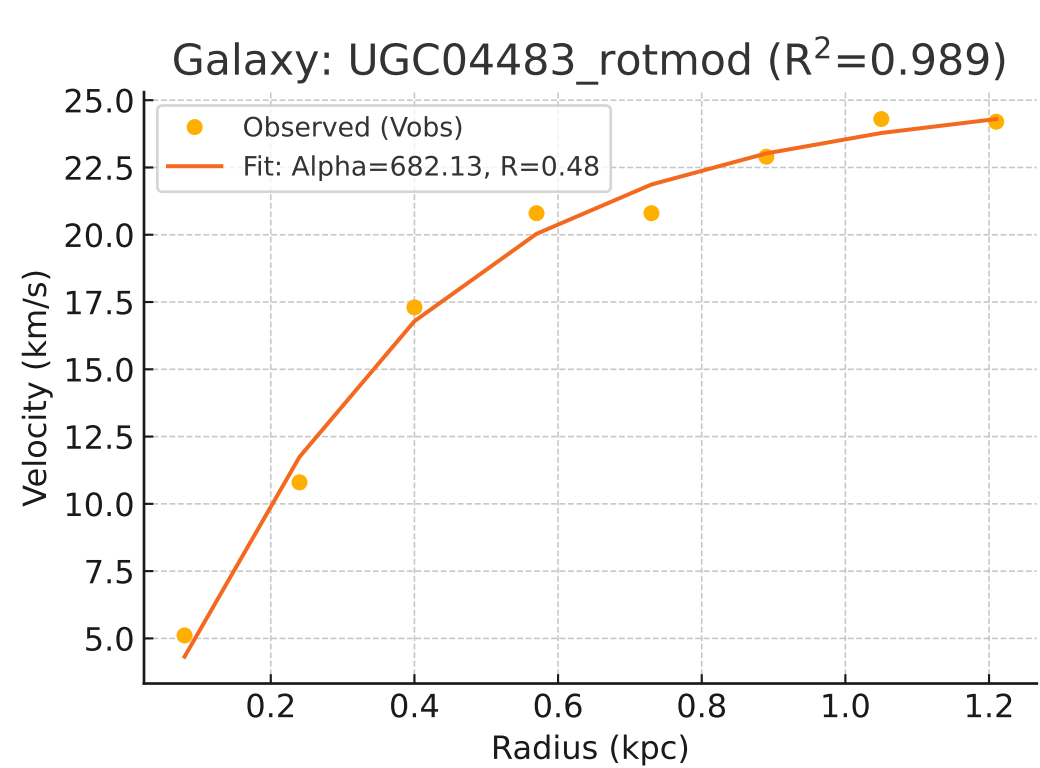

Galaxy: UGC03546_rotmod (R^2=-0.054)
Observed (Vobs)
Fit: Alpha=45058.11, R=0.10
Velocity (km/s)
Radius (kpc)
260
250
240
230
220
210
200
190
0
5
10
15
20
25
30

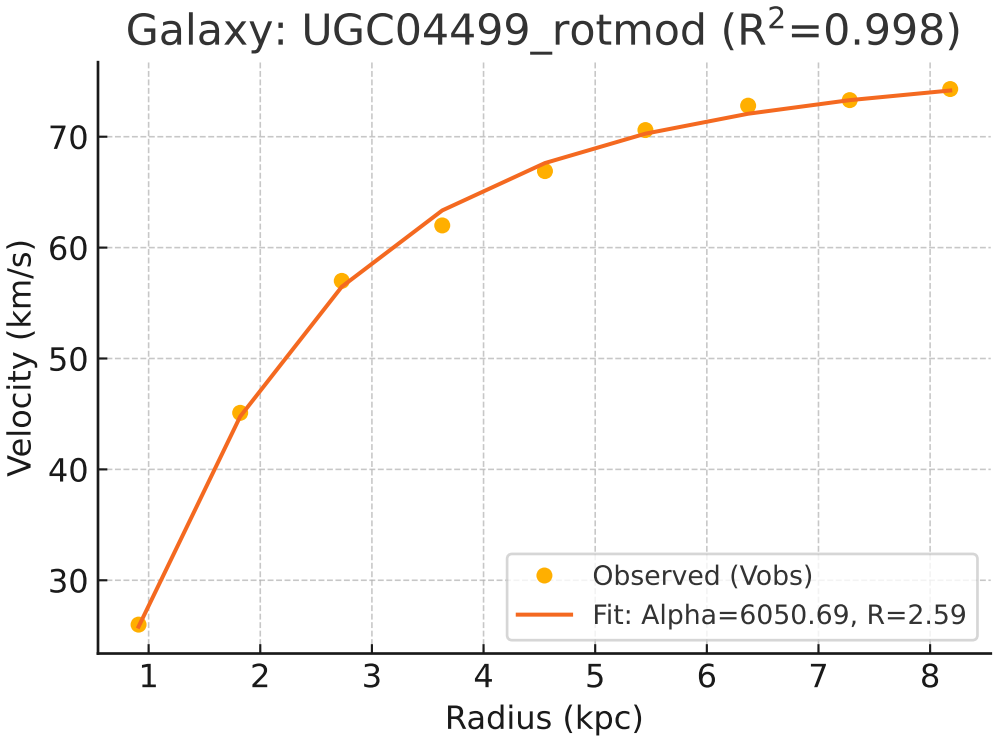

Galaxy: UGC03580_rotmod (R^2=0.385)
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
20
0
5
10
15
20
25
Observed (Vobs)
Fit: Alpha=11789.17, R=1.22

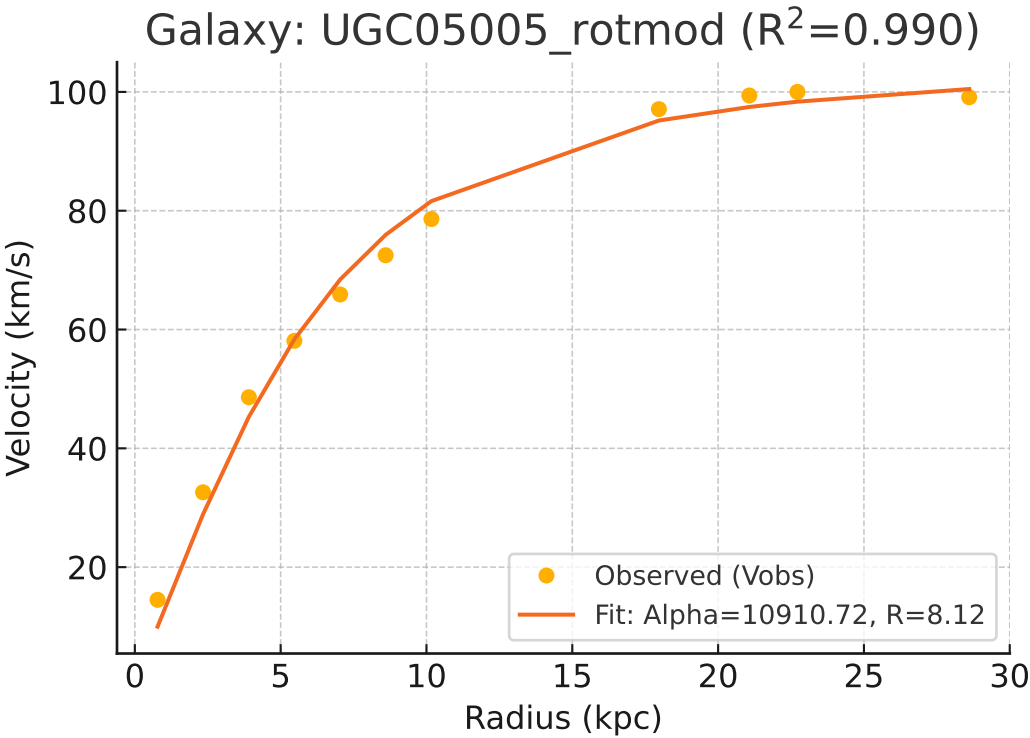

Galaxy: UGC04278_rotmod (R^2=0.951)
Observed (Vobs)
Fit: Alpha=14195.61, R=5.80
Velocity (km/s)
Radius (kpc)
0
20
40
60
80
0
1
2
3
4
5
6
7

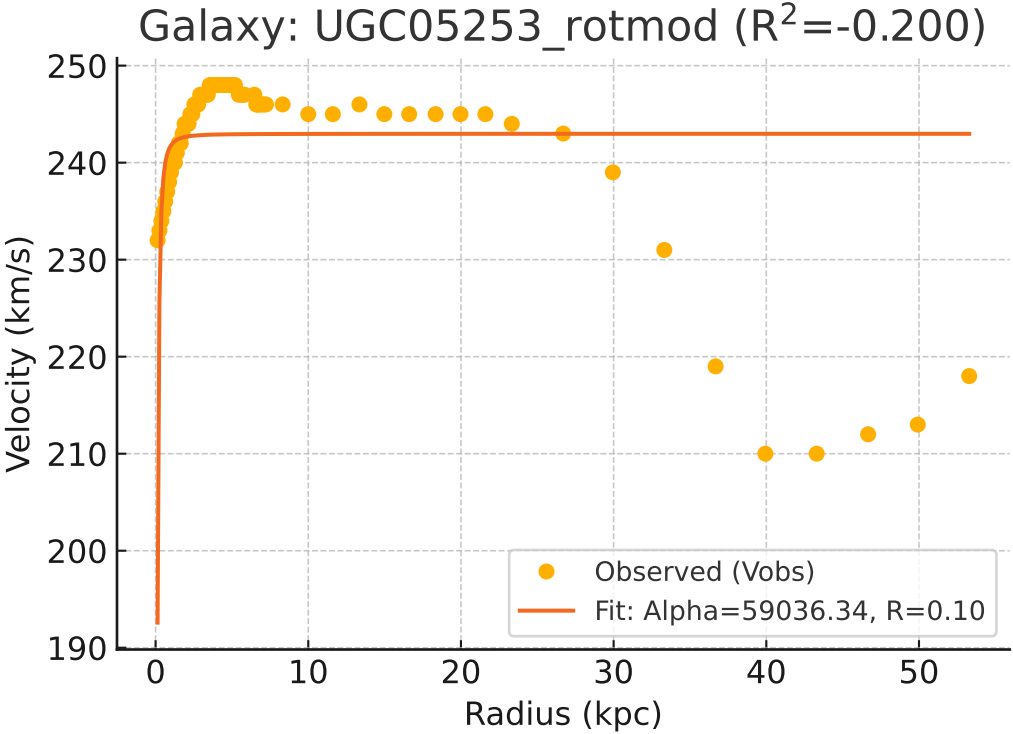

Galaxy: UGC04305_rotmod (R^2=0.874)
Velocity (km/s)
Radius (kpc)
0
1
2
3
4
5
5
10
15
20
25
30
35
Observed (Vobs)
Fit: Alpha=1290.29, R=1.08

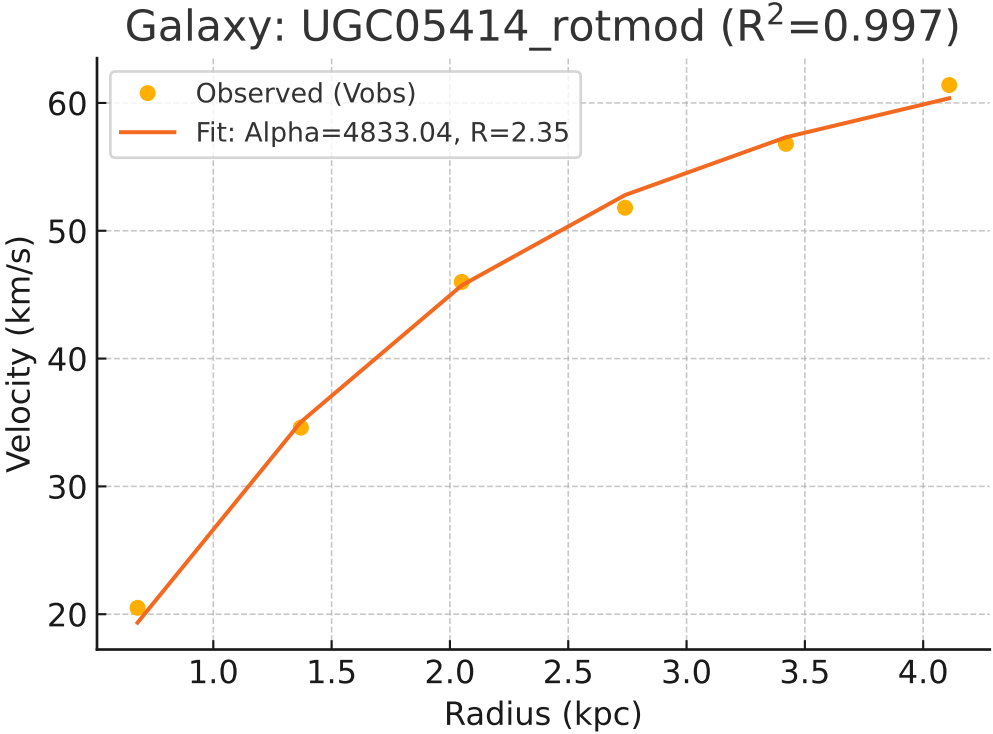

Galaxy: UGC04325_rotmod (R^2=0.989)
Velocity (km/s)
Radius (kpc)
90
80
70
60
50
40
1
2
3
4
5
Observed (Vobs)
Fit: Alpha=9373.46, R=1.38

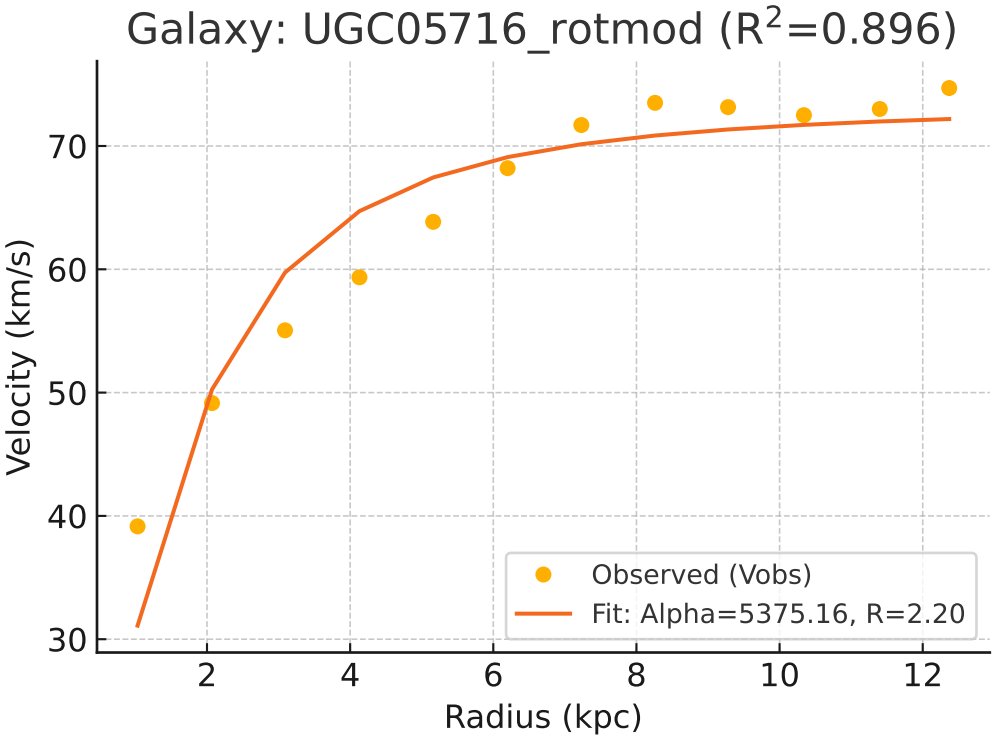

Galaxy: UGC04483_rotmod (R^2=0.989)
Observed (Vobs)
Fit: Alpha=682.13, R=0.48
Velocity (km/s)
Radius (kpc)
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
0.2
0.4
0.6
0.8
1.0
1.2

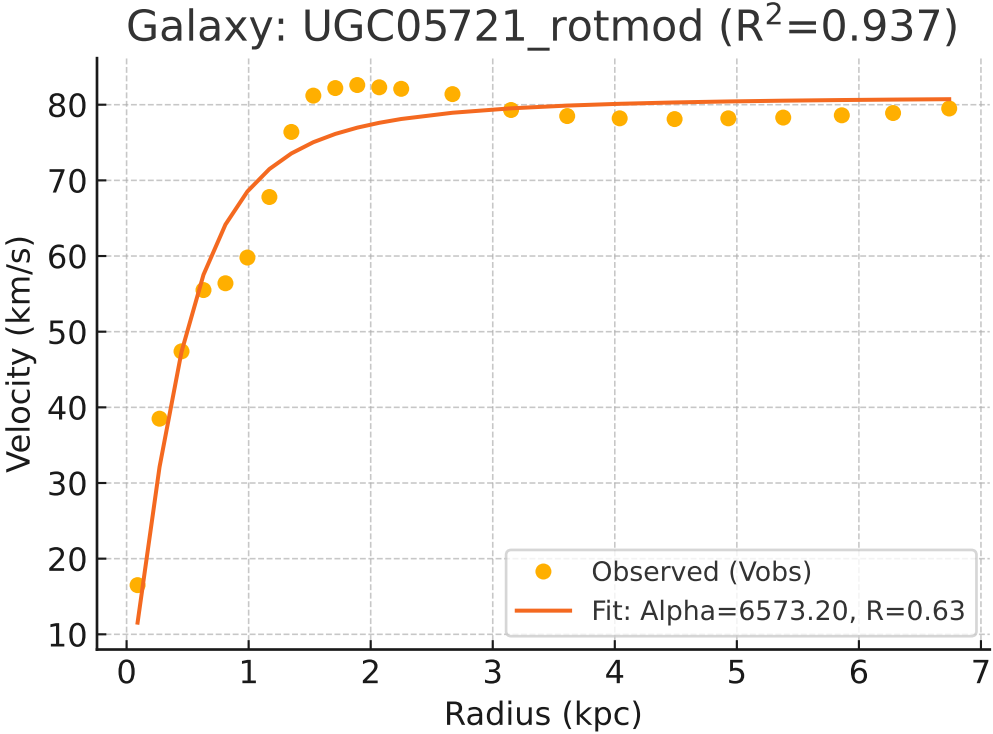

Galaxy: UGC04499_rotmod (R^2=0.998)
Velocity (km/s)
Radius (kpc)
30
40
50
60
70
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=6050.69, R=2.59

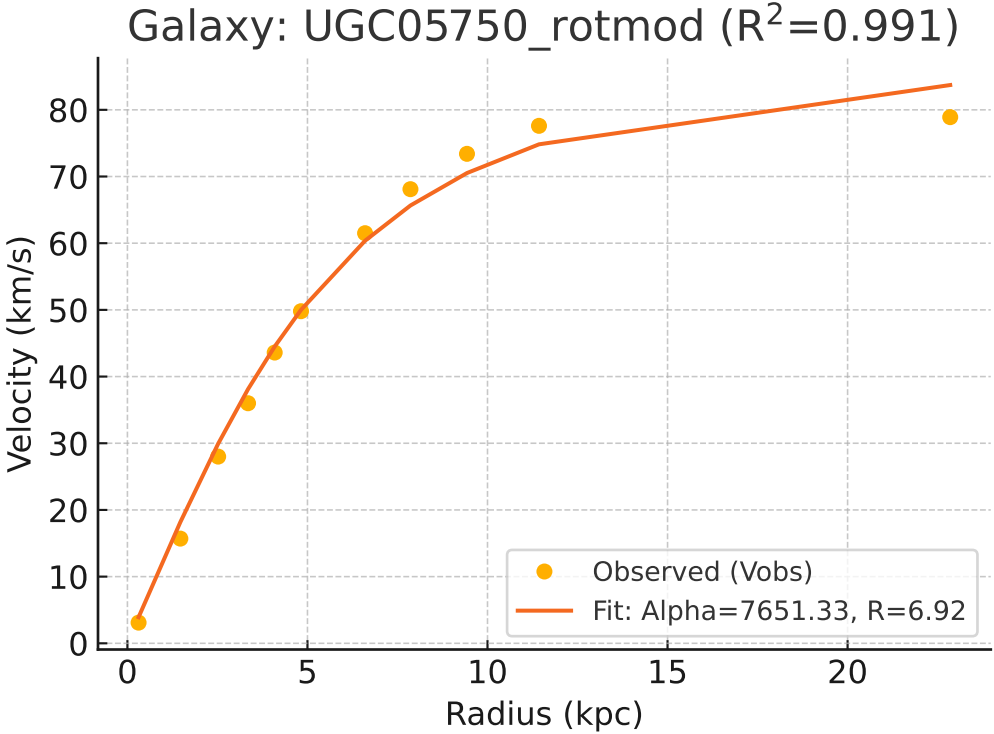

Galaxy: UGC05005_rotmod (R^2=0.990)
Velocity (km/s)
Radius (kpc)
100
80
60
40
20
0
5
10
15
20
25
30
Observed (Vobs)
Fit: Alpha=10910.72, R=8.12

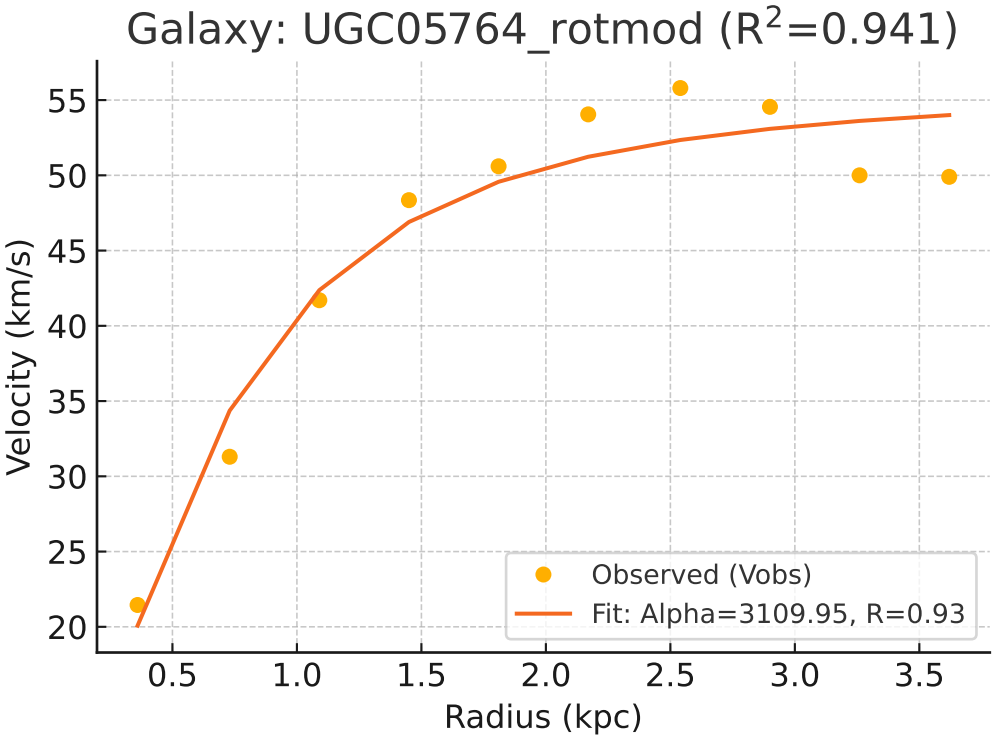

Galaxy: UGC05253_rotmod (R^2=-0.200)
Velocity (km/s)
Radius (kpc)
250
240
230
220
210
200
190
0
10
20
30
40
50
Observed (Vobs)
Fit: Alpha=59036.34, R=0.10

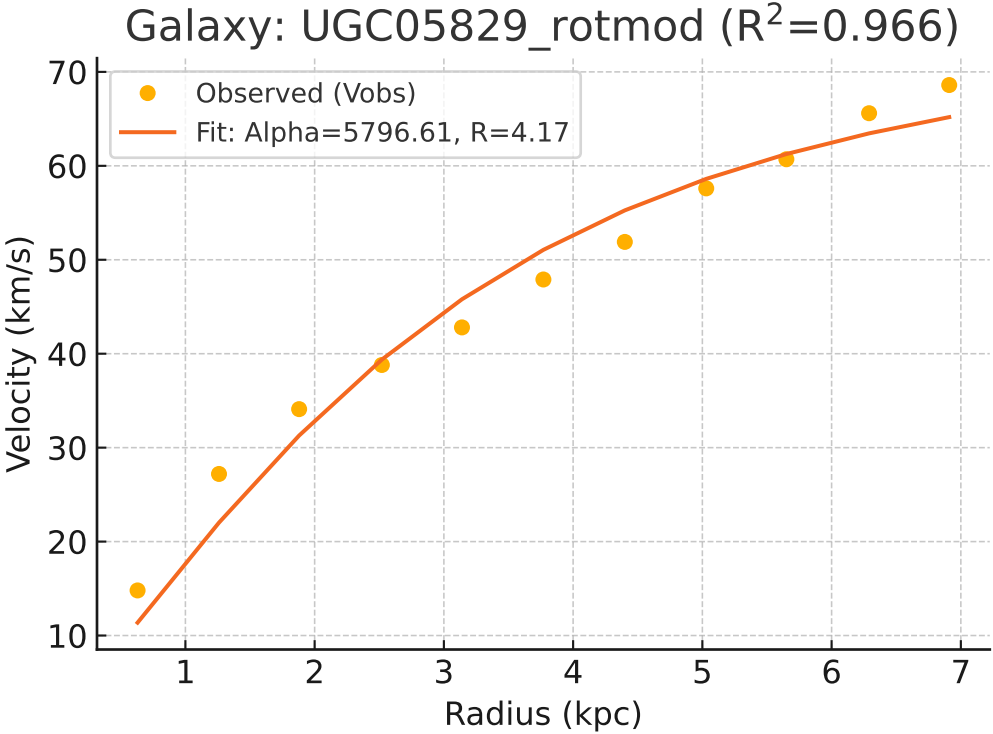

Galaxy: UGC05414_rotmod (R^2=0.997)
Observed (Vobs)
Fit: Alpha=4833.04, R=2.35
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
1.0
1.5
2.0
2.5
3.0
3.5
4.0

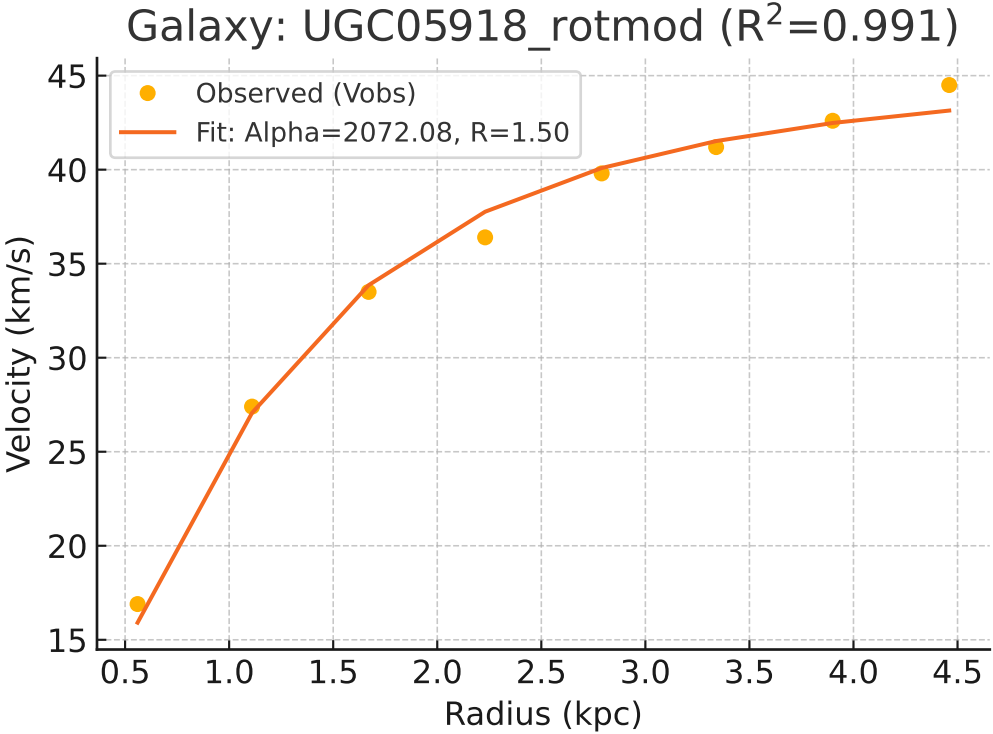

Galaxy: UGC05716_rotmod (R^2=0.896)
Velocity (km/s)
Radius (kpc)
30
40
50
60
70
2
4
6
8
10
12
Observed (Vobs)
Fit: Alpha=5375.16, R=2.20

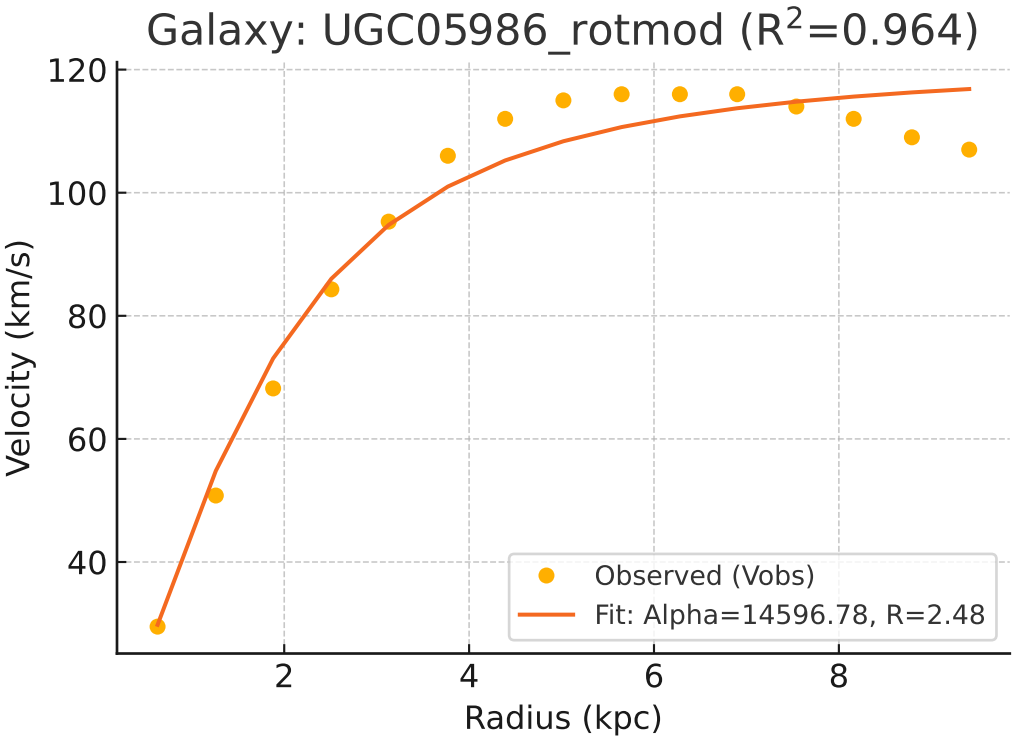

Galaxy: UGC05721_rotmod (R^2=0.937)
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
70
80
0
1
2
3
4
5
6
7
Observed (Vobs)
Fit: Alpha=6573.20, R=0.63

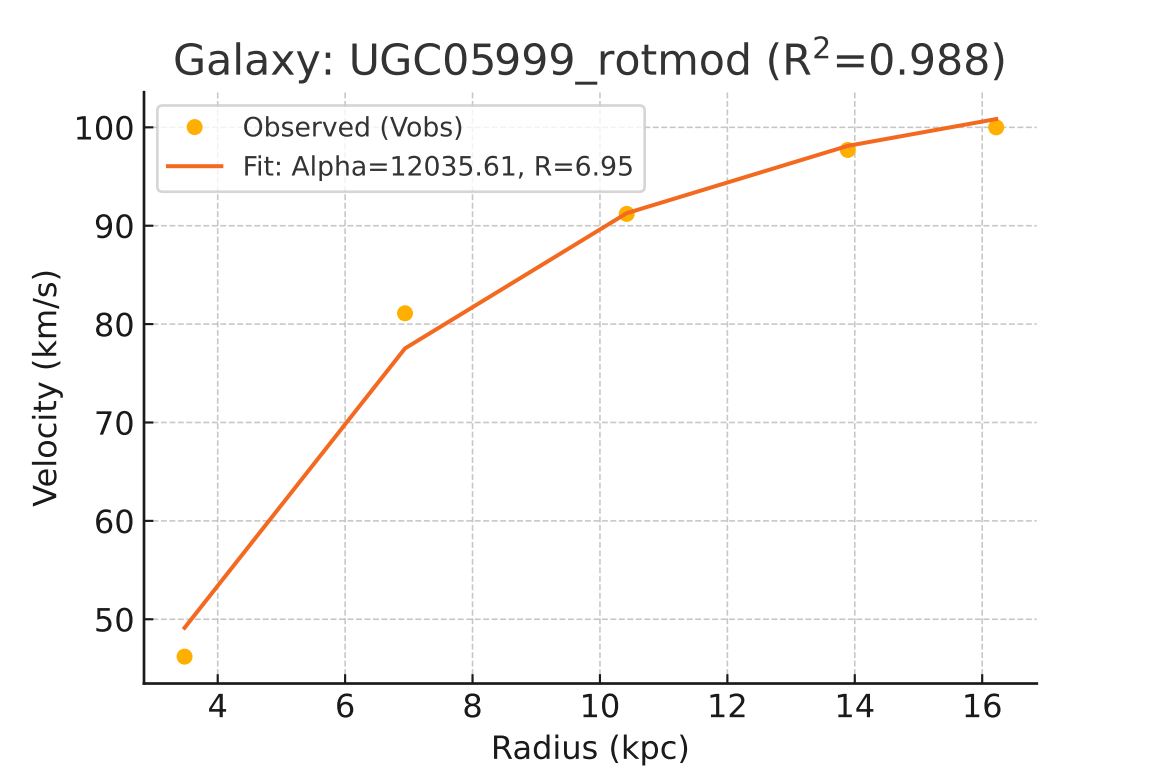

Galaxy: UGC05750_rotmod (R^2=0.991)
Velocity (km/s)
Radius (kpc)
0
10
20
30
40
50
60
70
80
0
5
10
15
20
Observed (Vobs)
Fit: Alpha=7651.33, R=6.92

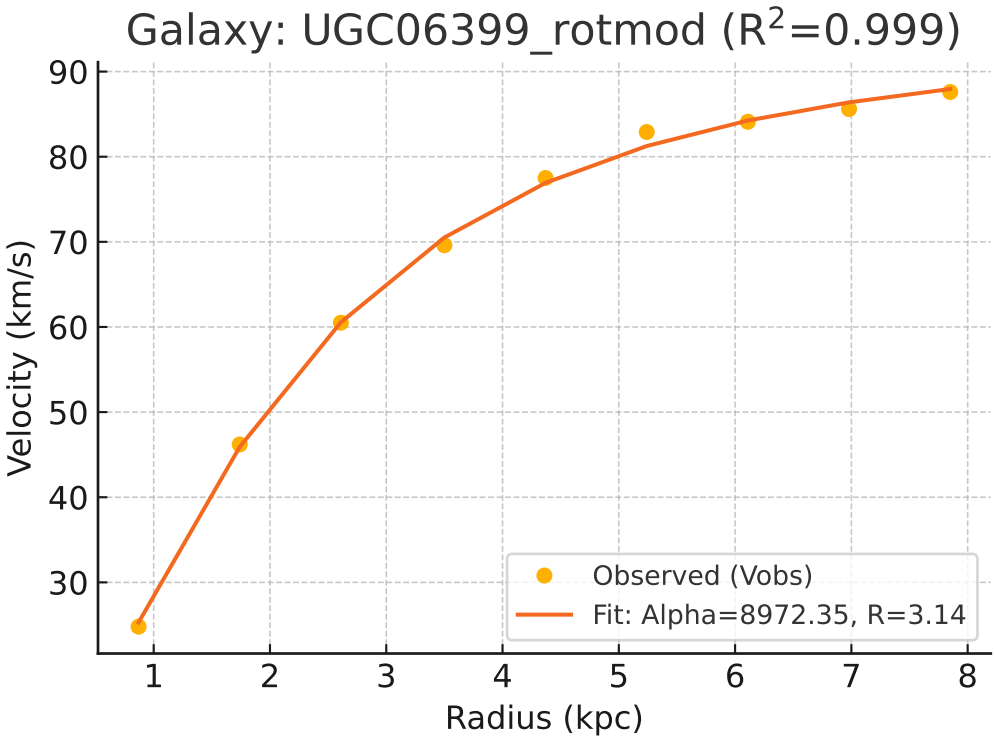

Galaxy: UGC05764_rotmod (R^2=0.941)
Velocity (km/s)
Radius (kpc)
20
25
30
35
40
45
50
55
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Observed (Vobs)
Fit: Alpha=3109.95, R=0.93

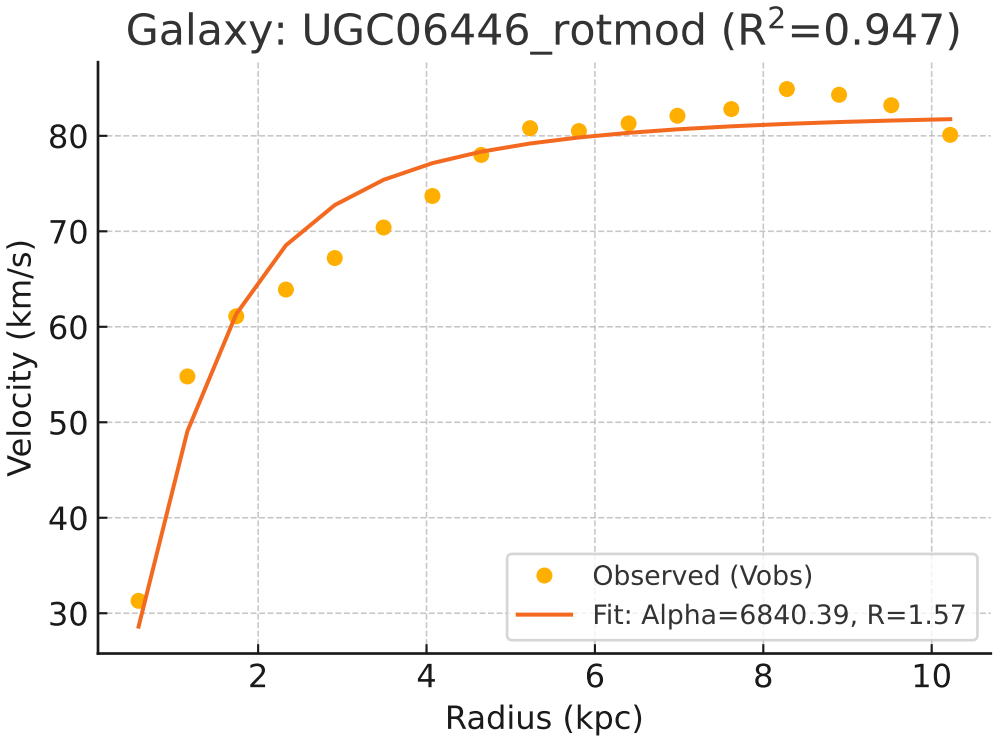

Galaxy: UGC05829_rotmod (R^2=0.966)
Observed (Vobs)
Fit: Alpha=5796.61, R=4.17
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
70
1
2
3
4
5
6
7

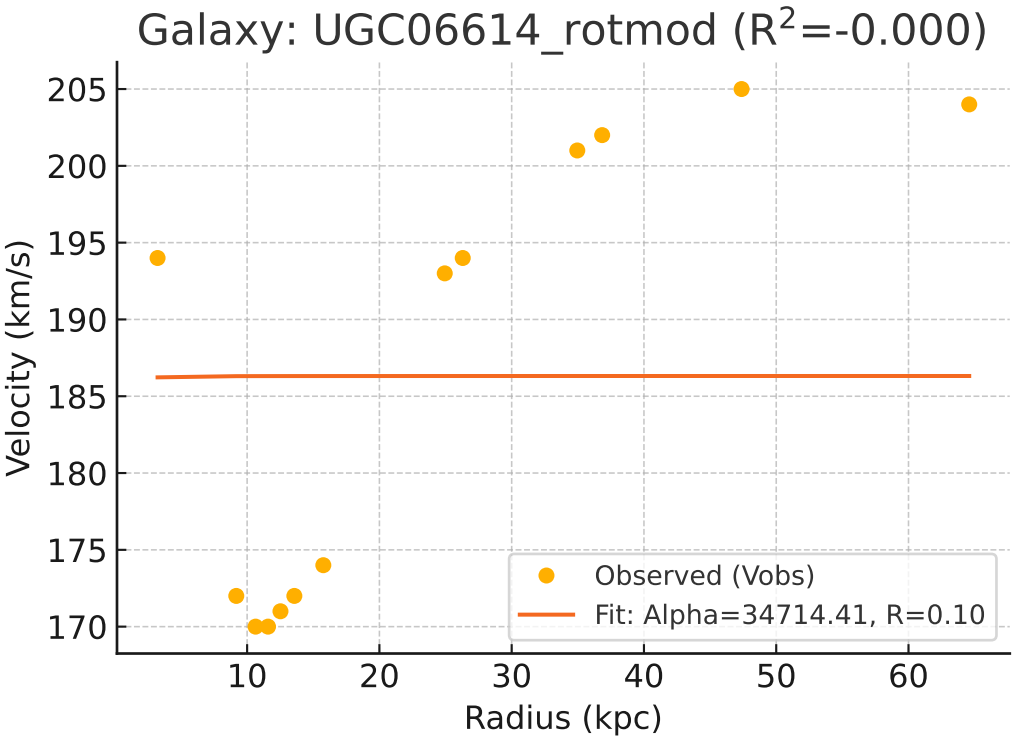

Galaxy: UGC05918_rotmod (R^2=0.991)
Observed (Vobs)
Fit: Alpha=2072.08, R=1.50
Velocity (km/s)
Radius (kpc)
45
40
35
30
25
20
15
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

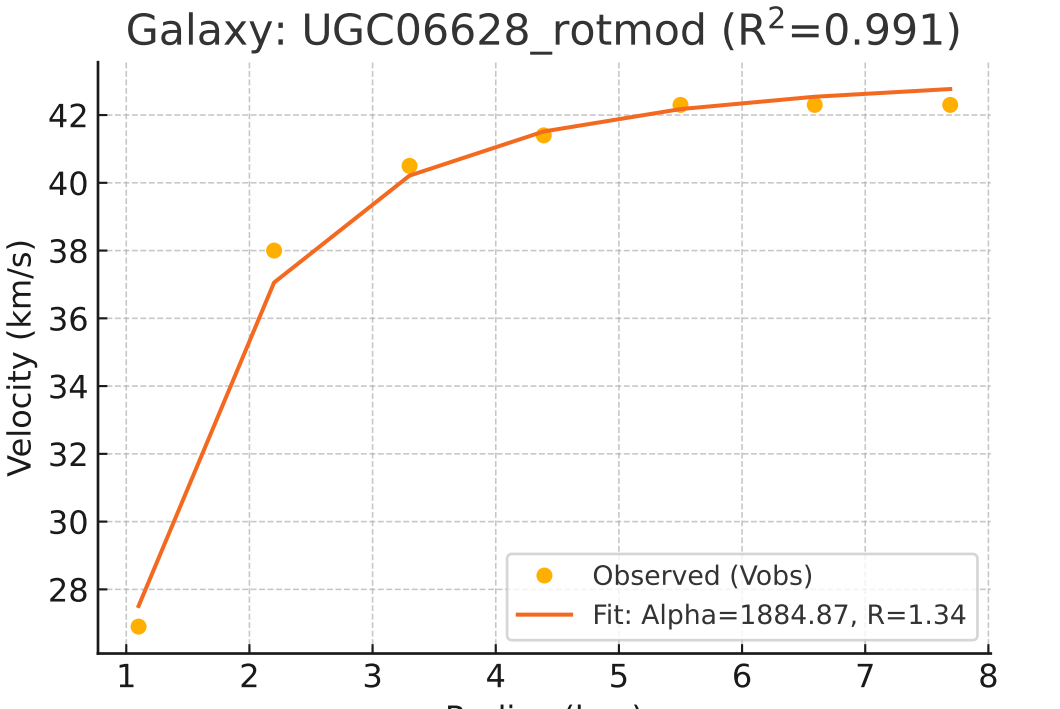

Galaxy: UGC05986_rotmod (R^2=0.964)
Velocity (km/s)
Radius (kpc)
120
100
80
60
40
2
4
6
8
Observed (Vobs)
Fit: Alpha=14596.78, R=2.48

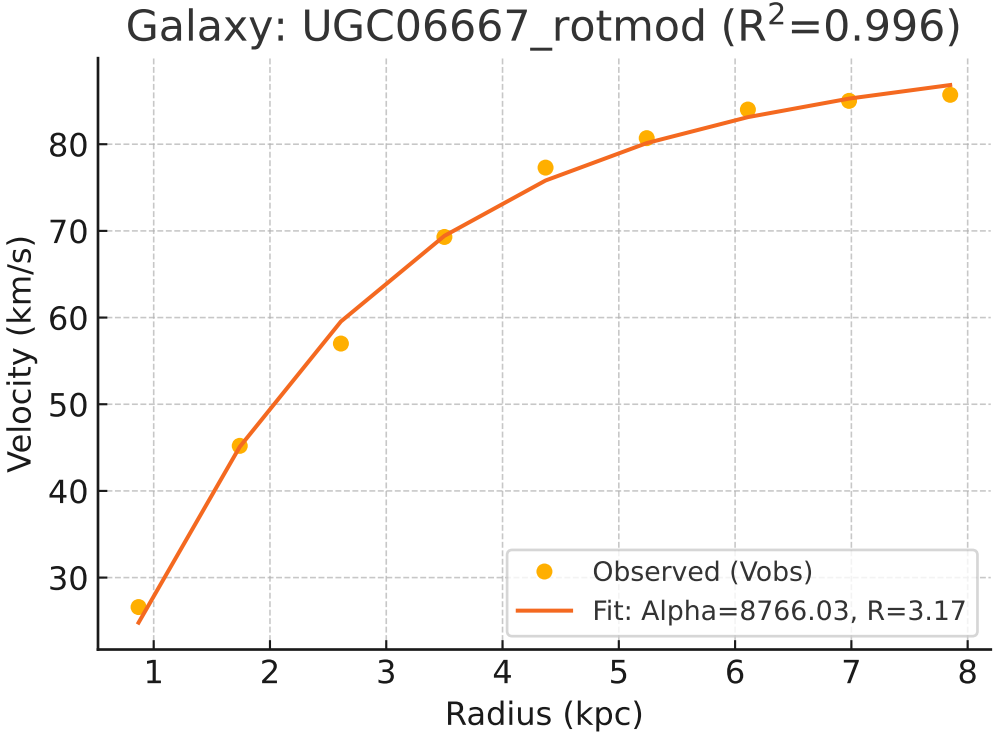

Galaxy: UGC05999_rotmod (R^2=0.988)
Observed (Vobs)
Fit: Alpha=12035.61, R=6.95
Velocity (km/s)
Radius (kpc)
50
60
70
80
90
100
4
6
8
10
12
14
16

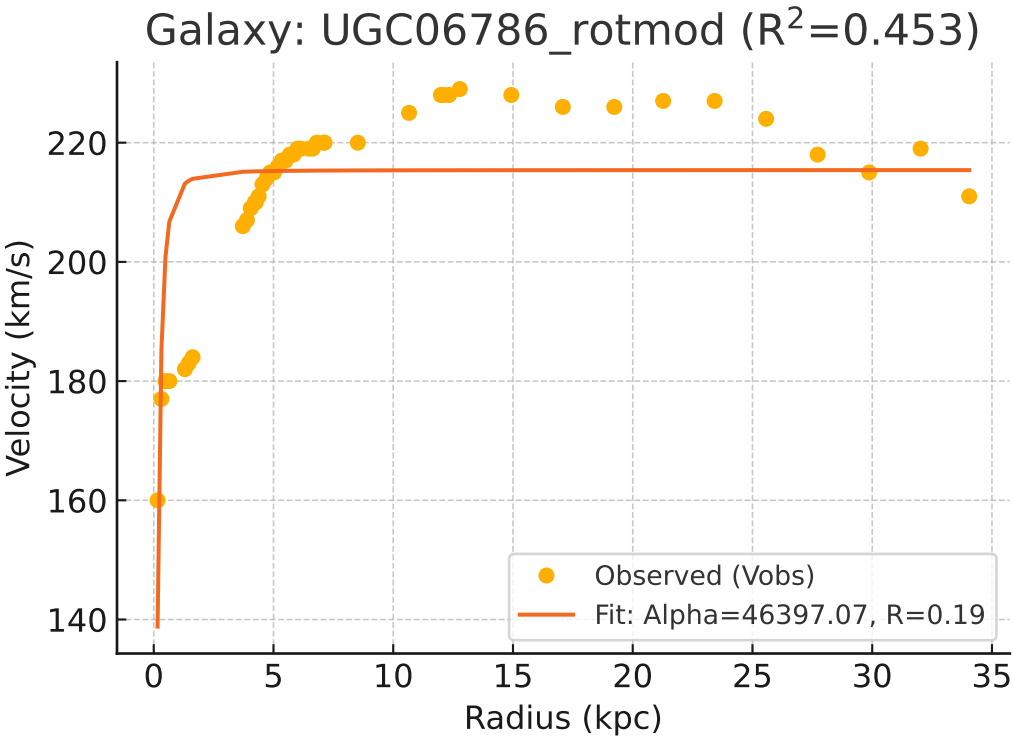

Galaxy: UGC06399_rotmod (R^2=0.999)
Velocity (km/s)
Radius (kpc)
90
80
70
60
50
40
30
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=8972.35, R=3.14

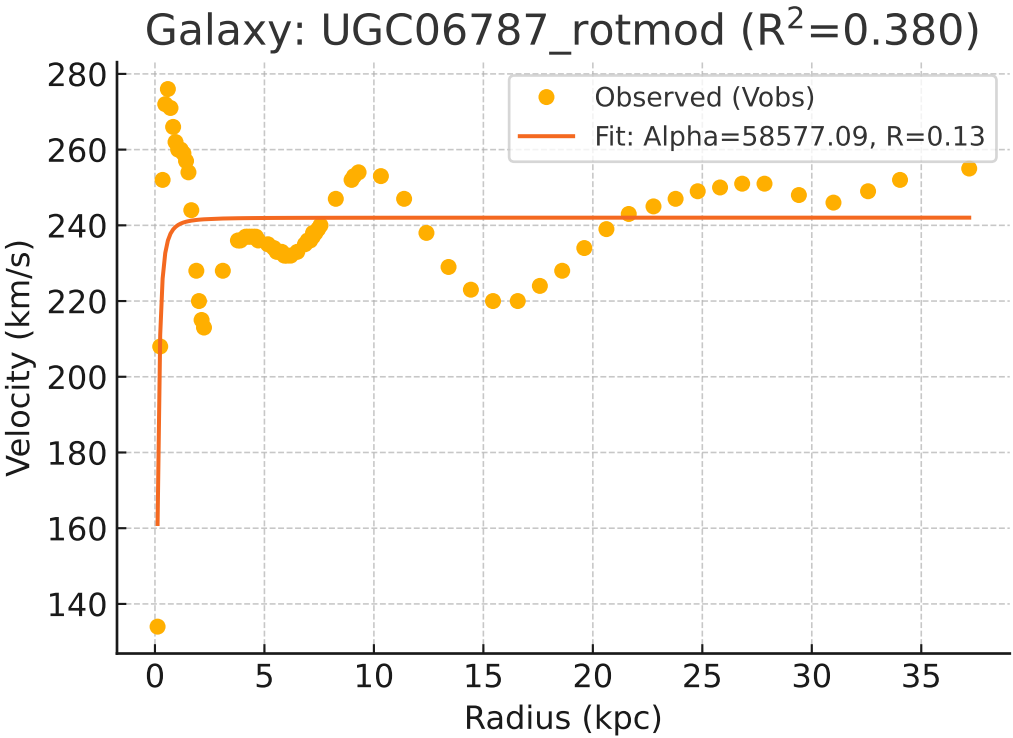

Galaxy: UGC06446_rotmod (R^2=0.947)
Velocity (km/s)
Radius (kpc)
30
40
50
60
70
80
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=6840.39, R=1.57

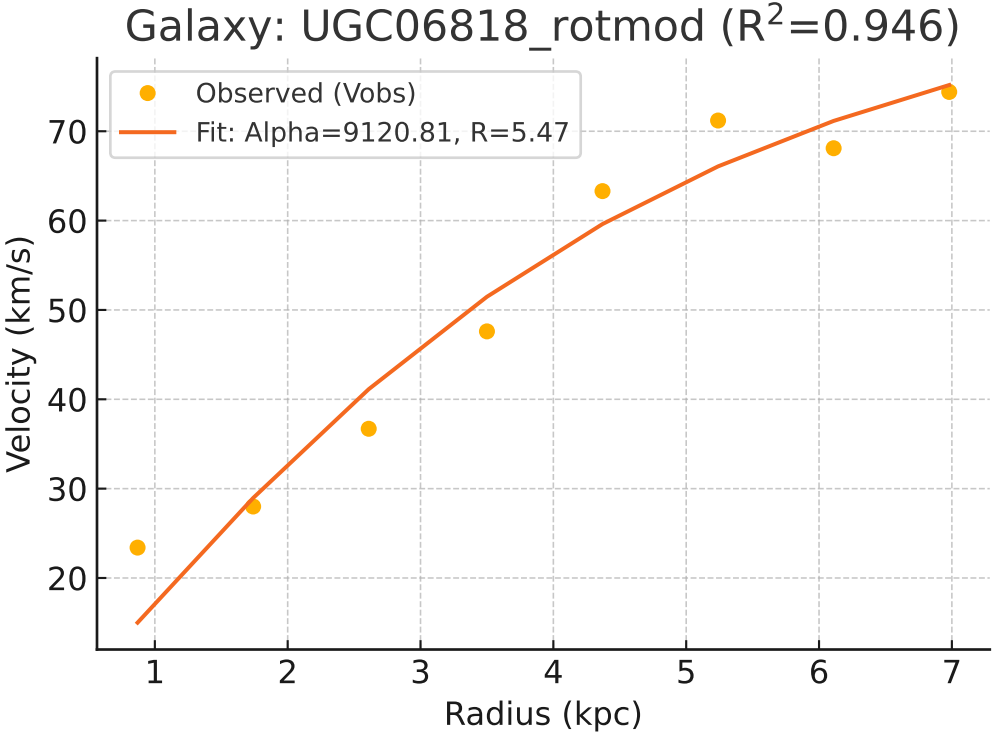

Galaxy: UGC06614_rotmod (R^2=-0.000)
Velocity (km/s)
Radius (kpc)
205
200
195
190
185
180
175
170
10
20
30
40
50
60
Observed (Vobs)
Fit: Alpha=34714.41, R=0.10

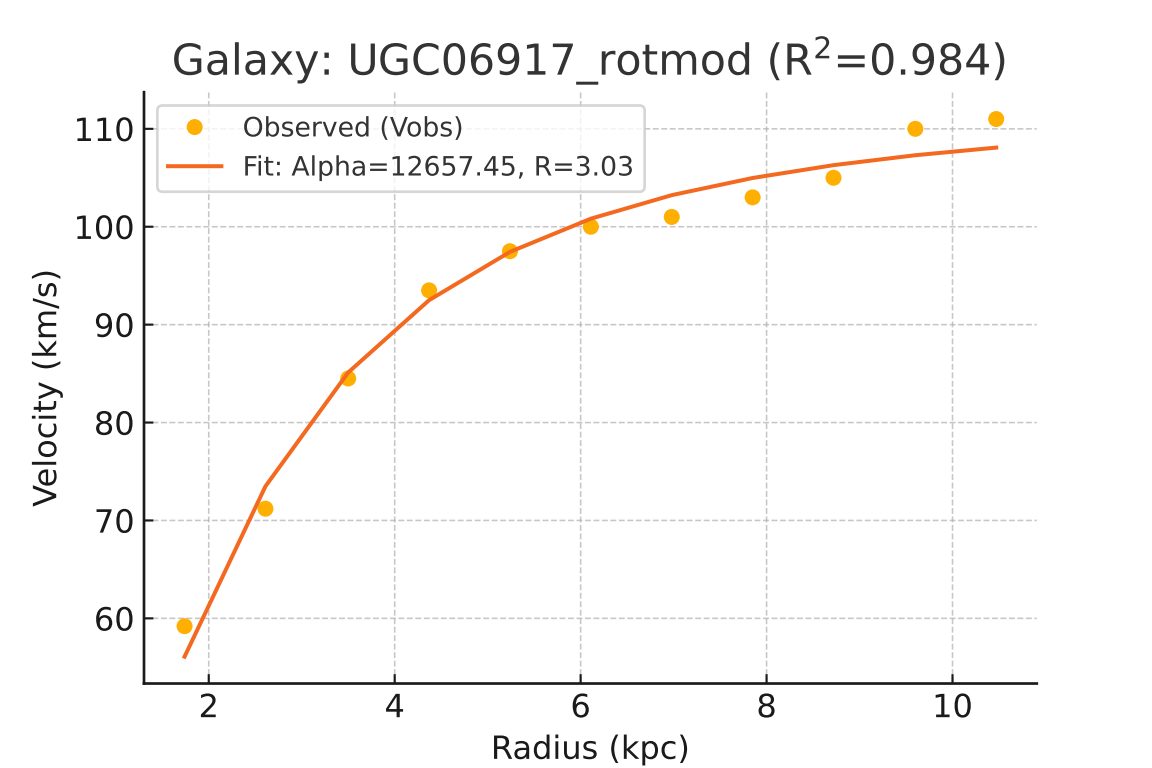

Galaxy: UGC06628_rotmod (R^2=0.991)
Velocity (km/s)
Radius (kpc)
28
30
32
34
36
38
40
42
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=1884.87, R=1.34

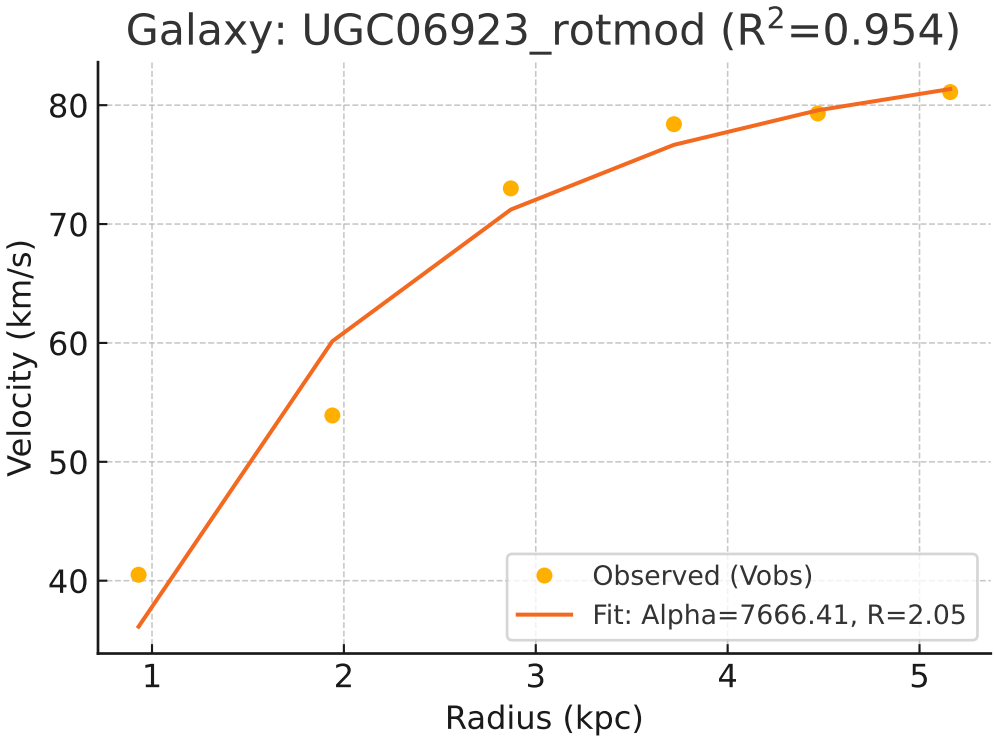

Galaxy: UGC06667_rotmod (R^2=0.996)
Velocity (km/s)
Radius (kpc)
30
40
50
60
70
80
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=8766.03, R=3.17

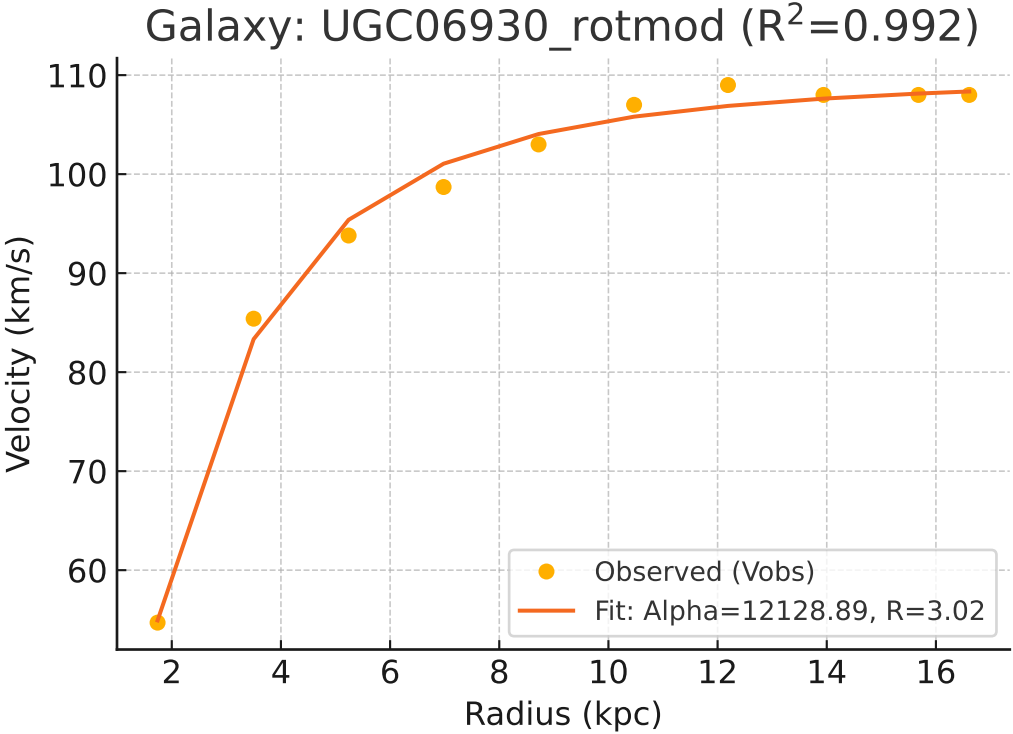

Galaxy: UGC06786_rotmod (R^2=0.453)
Velocity (km/s)
Radius (kpc)
140
160
180
200
220
0
5
10
15
20
25
30
35
Observed (Vobs)
Fit: Alpha=46397.07, R=0.19

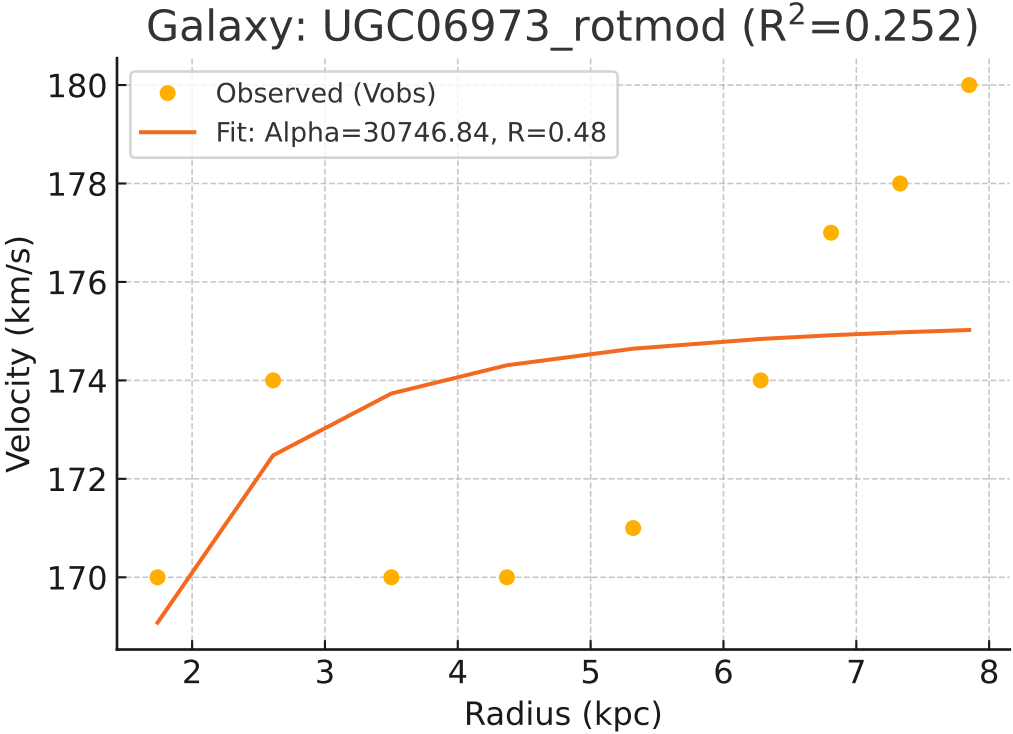

Galaxy: UGC06787_rotmod (R^2=0.380)
Observed (Vobs)
Fit: Alpha=58577.09, R=0.13
Velocity (km/s)
Radius (kpc)
280
260
240
220
200
180
160
140
0
5
10
15
20
25
30
35

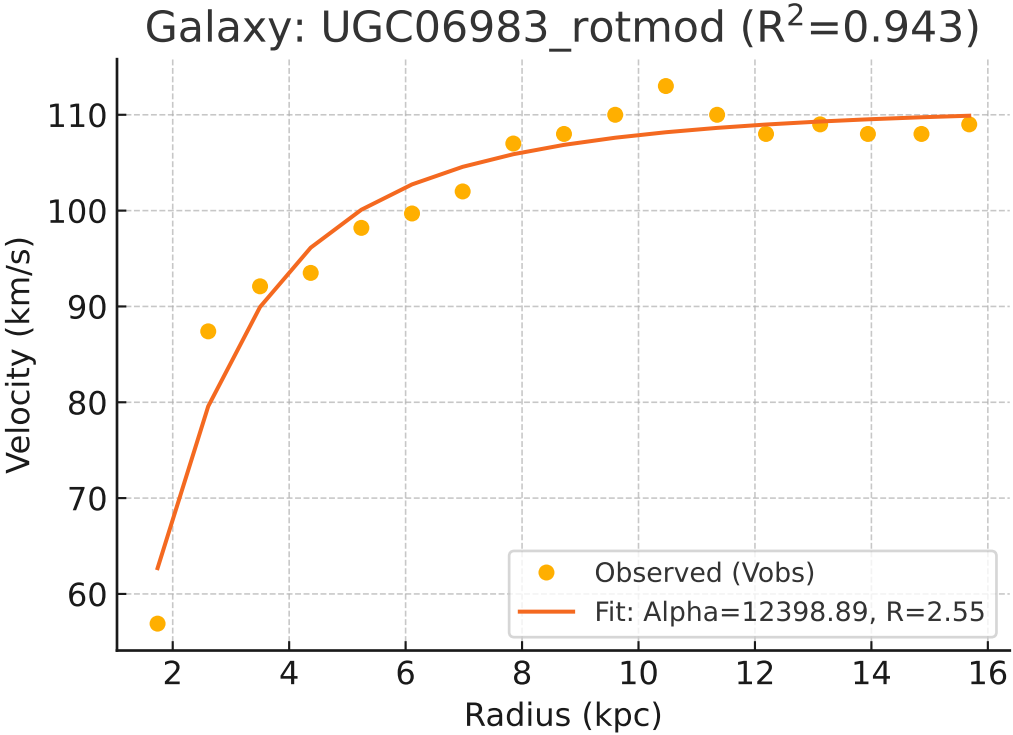

Galaxy: UGC06818_rotmod (R^2=0.946)
Observed (Vobs)
Fit: Alpha=9120.81, R=5.47
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
70
1
2
3
4
5
6
7

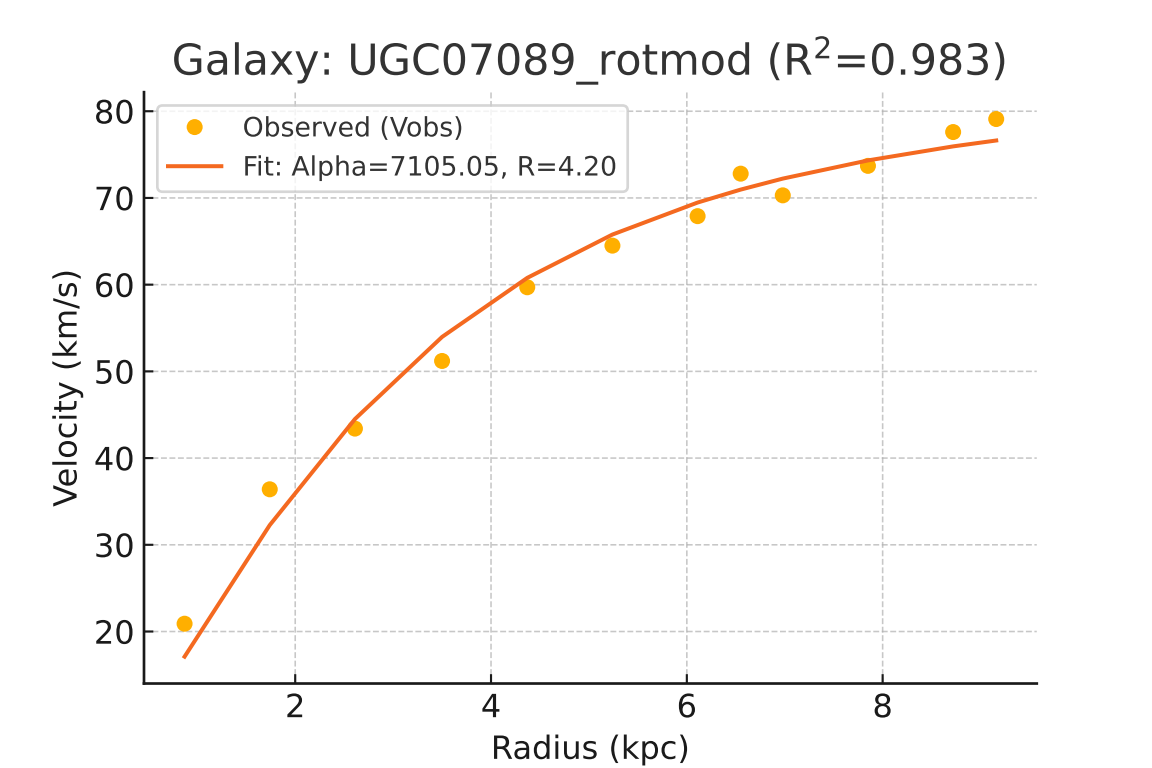

Galaxy: UGC06917_rotmod (R^2=0.984)
Observed (Vobs)
Fit: Alpha=12657.45, R=3.03
Velocity (km/s)
Radius (kpc)
110
100
90
80
70
60
2
4
6
8
10

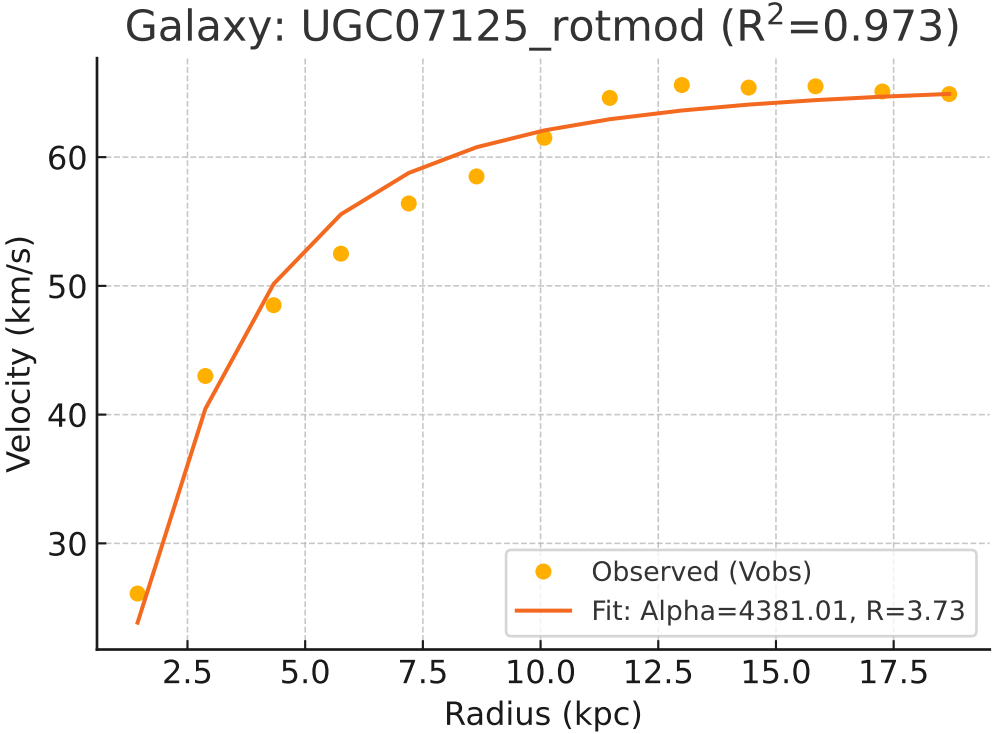

Galaxy: UGC06923_rotmod (R^2=0.954)
Velocity (km/s)
Radius (kpc)
80
70
60
50
40
1
2
3
4
5
Observed (Vobs)
Fit: Alpha=7666.41, R=2.05

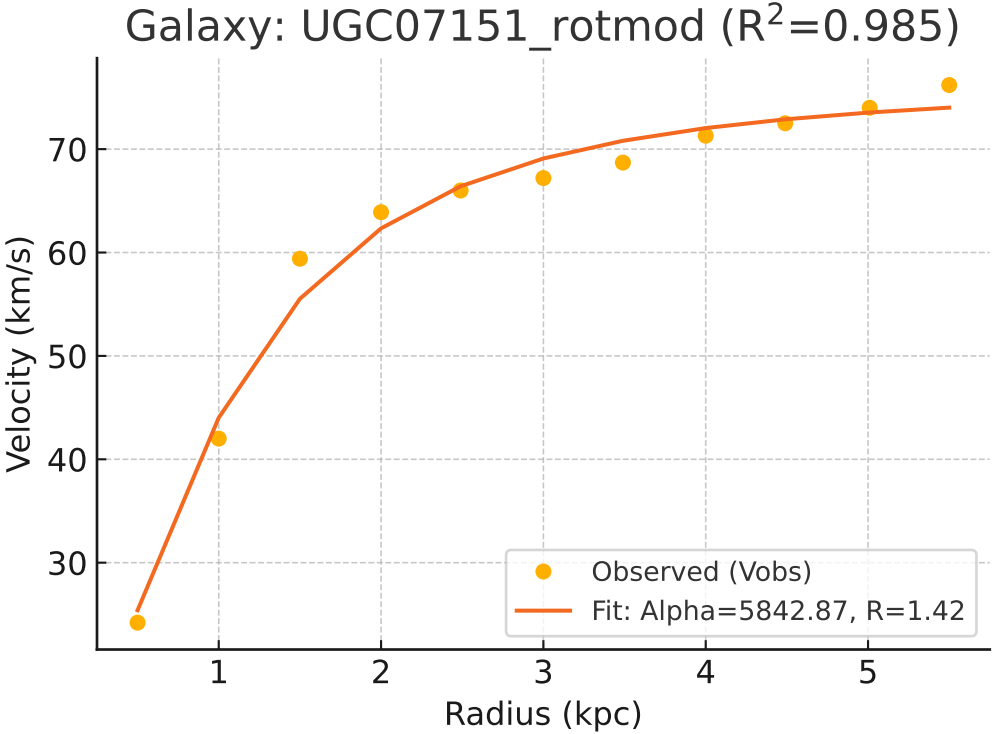

Galaxy: UGC06930_rotmod (R^2=0.992)
Velocity (km/s)
Radius (kpc)
110
100
90
80
70
60
2
4
6
8
10
12
14
16
Observed (Vobs)
Fit: Alpha=12128.89, R=3.02

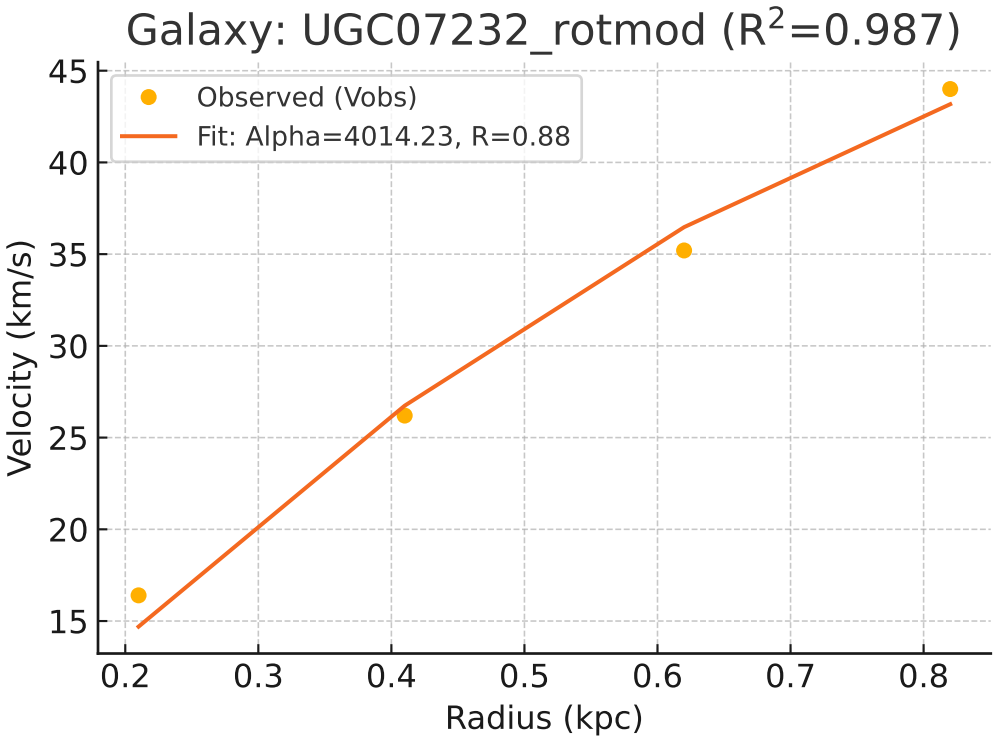

Galaxy: UGC06973_rotmod (R^2=0.252)
Observed (Vobs)
Fit: Alpha=30746.84, R=0.48
Velocity (km/s)
Radius (kpc)
180
178
176
174
172
170
2
3
4
5
6
7
8

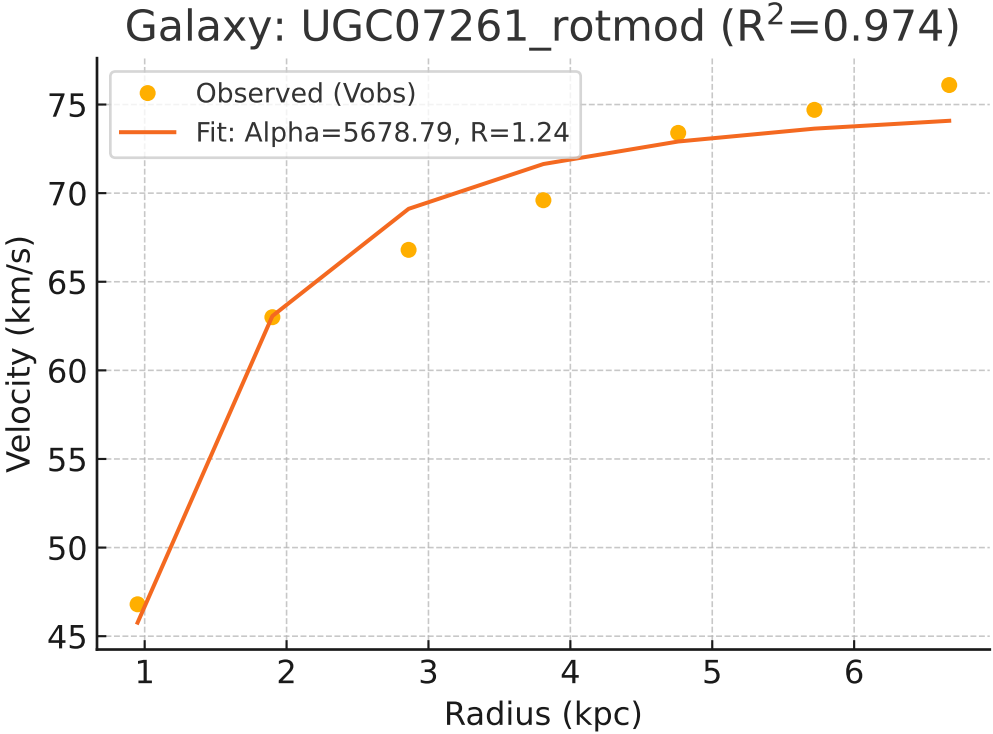

Galaxy: UGC06983_rotmod (R^2=0.943)
Velocity (km/s)
Radius (kpc)
110
100
90
80
70
60
2
4
6
8
10
12
14
16
Observed (Vobs)
Fit: Alpha=12398.89, R=2.55

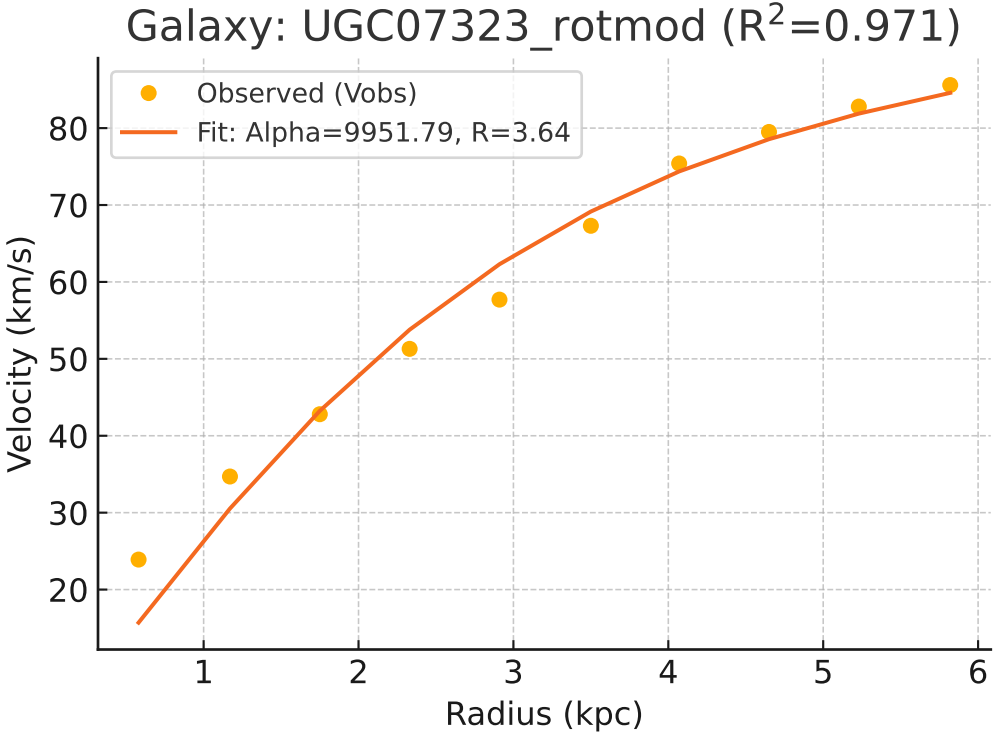

Galaxy: UGC07089_rotmod (R^2=0.983)
Observed (Vobs)
Fit: Alpha=7105.05, R=4.20
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
70
80
2
4
6
8

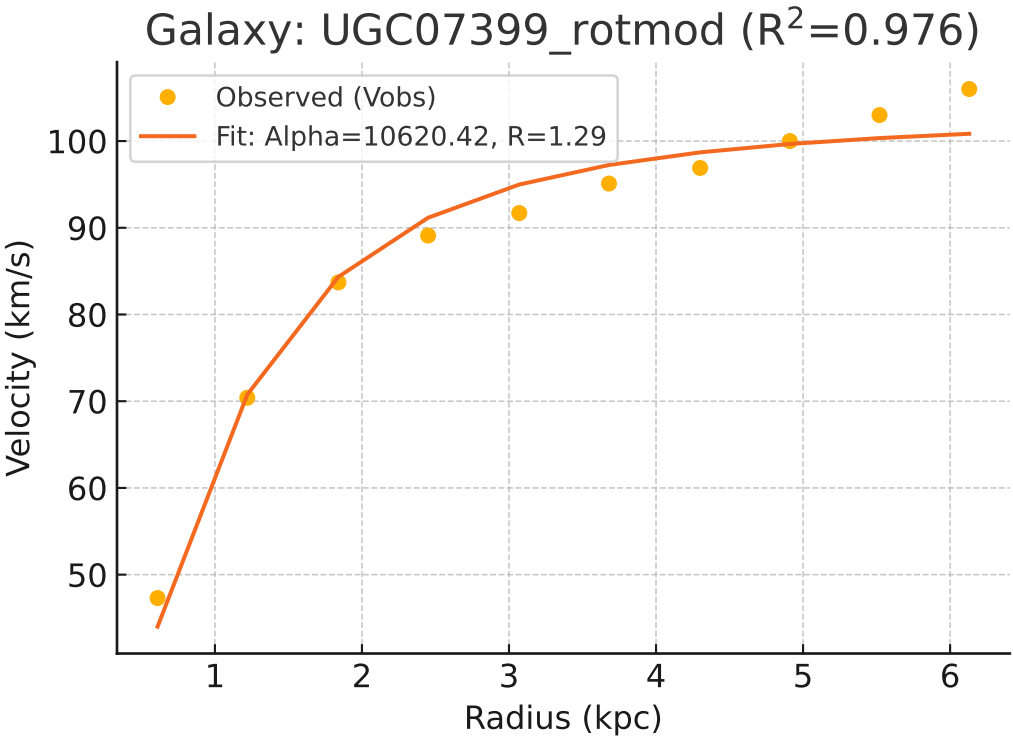

Galaxy: UGC07125_rotmod (R^2=0.973)
Velocity (km/s)
Radius (kpc)
60
50
40
30
2.5
5.0
7.5
10.0
12.5
15.0
17.5
Observed (Vobs)
Fit: Alpha=4381.01, R=3.73

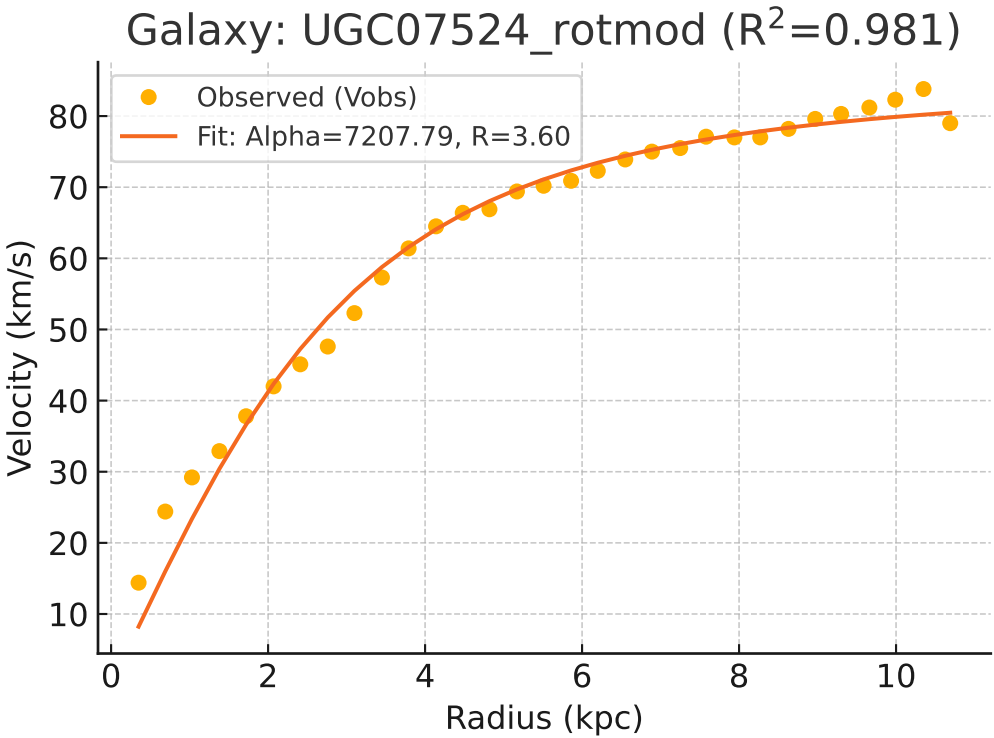

Galaxy: UGC07151_rotmod (R^2=0.985)
Velocity (km/s)
Radius (kpc)
70
60
50
40
30
1
2
3
4
5
Observed (Vobs)
Fit: Alpha=5842.87, R=1.42

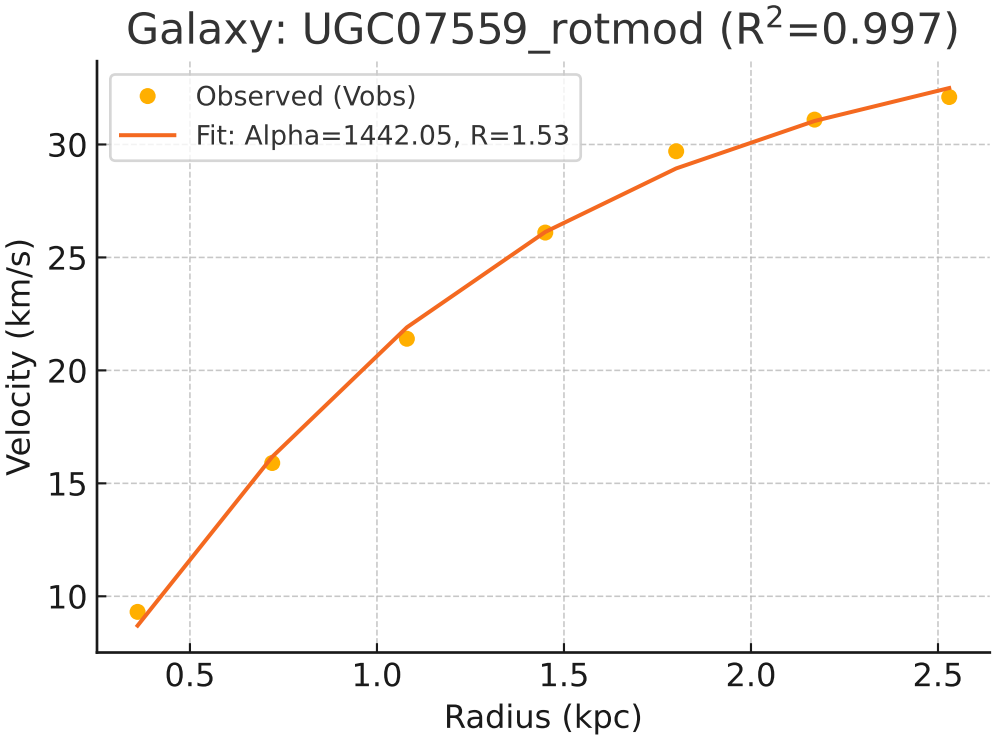

Galaxy: UGC07232_rotmod (R^2=0.987)
Observed (Vobs)
Fit: Alpha=4014.23, R=0.88
Velocity (km/s)
Radius (kpc)
45
40
35
30
25
20
15
0.2
0.3
0.4
0.5
0.6
0.7
0.8

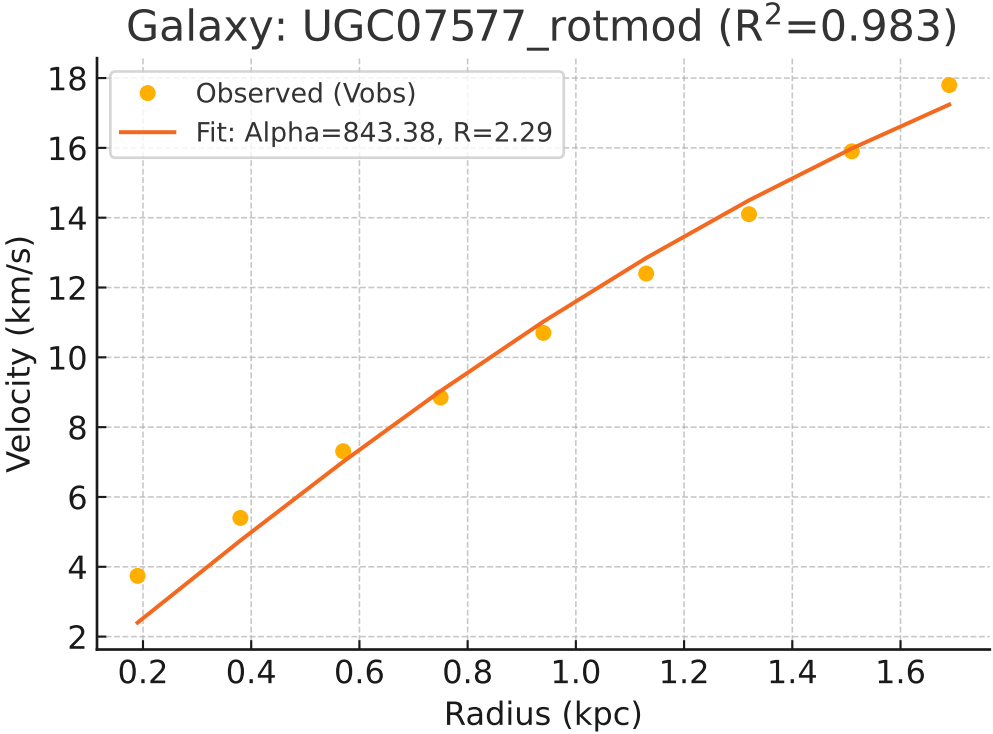

Galaxy: UGC07261_rotmod (R^2=0.974)
Observed (Vobs)
Fit: Alpha=5678.79, R=1.24
Velocity (km/s)
Radius (kpc)
45
50
55
60
65
70
75
1
2
3
4
5
6

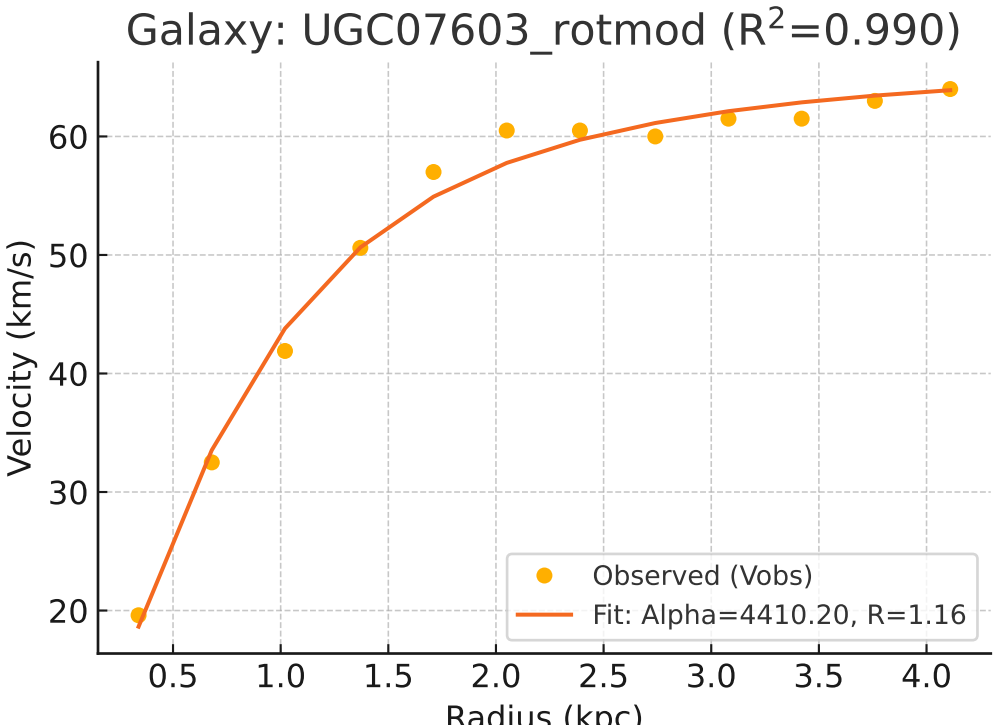

Galaxy: UGC07323_rotmod (R^2=0.971)
Observed (Vobs)
Fit: Alpha=9951.79, R=3.64
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
70
80
1
2
3
4
5
6

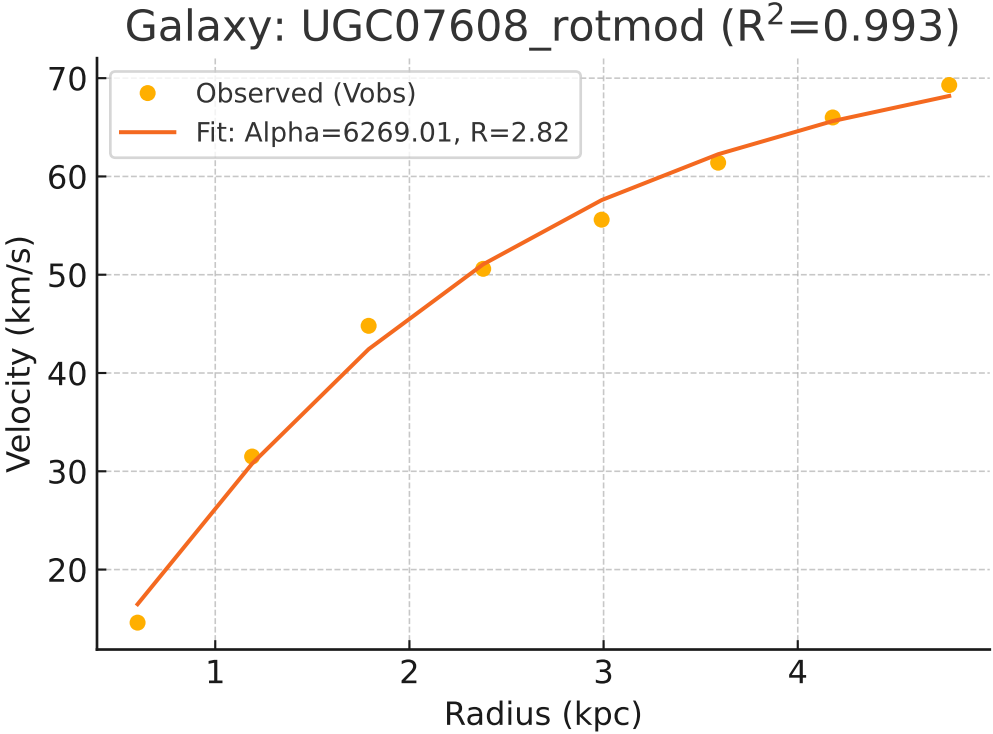

Galaxy: UGC07399_rotmod (R^2=0.976)
Observed (Vobs)
Fit: Alpha=10620.42, R=1.29
Velocity (km/s)
Radius (kpc)
100
90
80
70
60
50
1
2
3
4
5
6

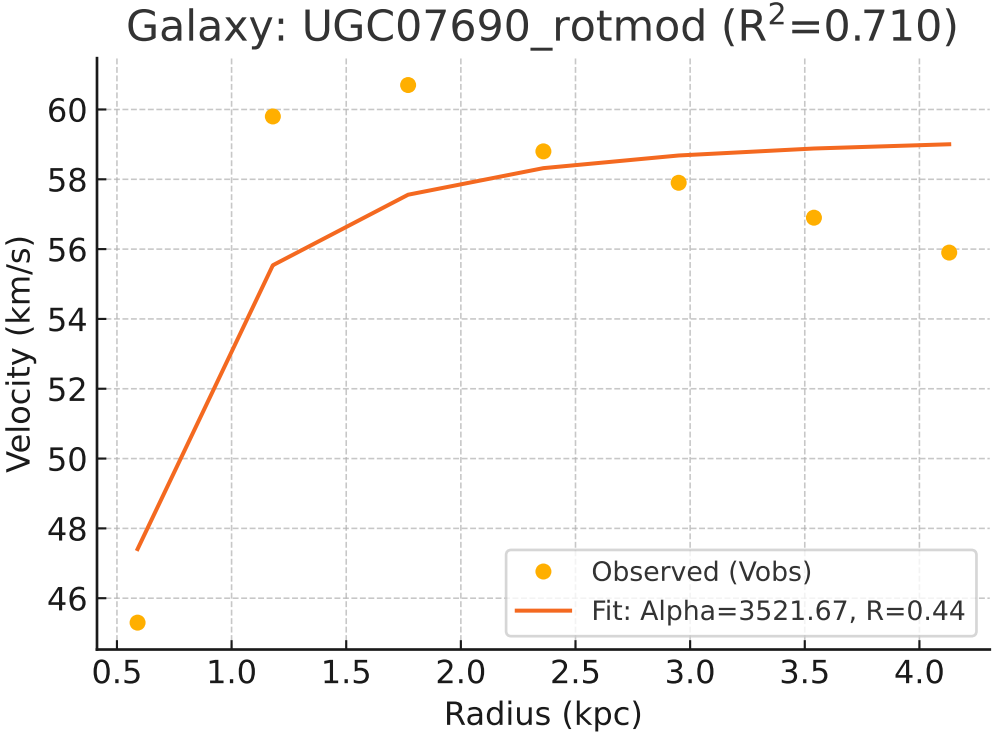

Galaxy: UGC07524_rotmod (R^2=0.981)
Observed (Vobs)
Fit: Alpha=7207.79, R=3.60
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
70
80
0
2
4
6
8
10

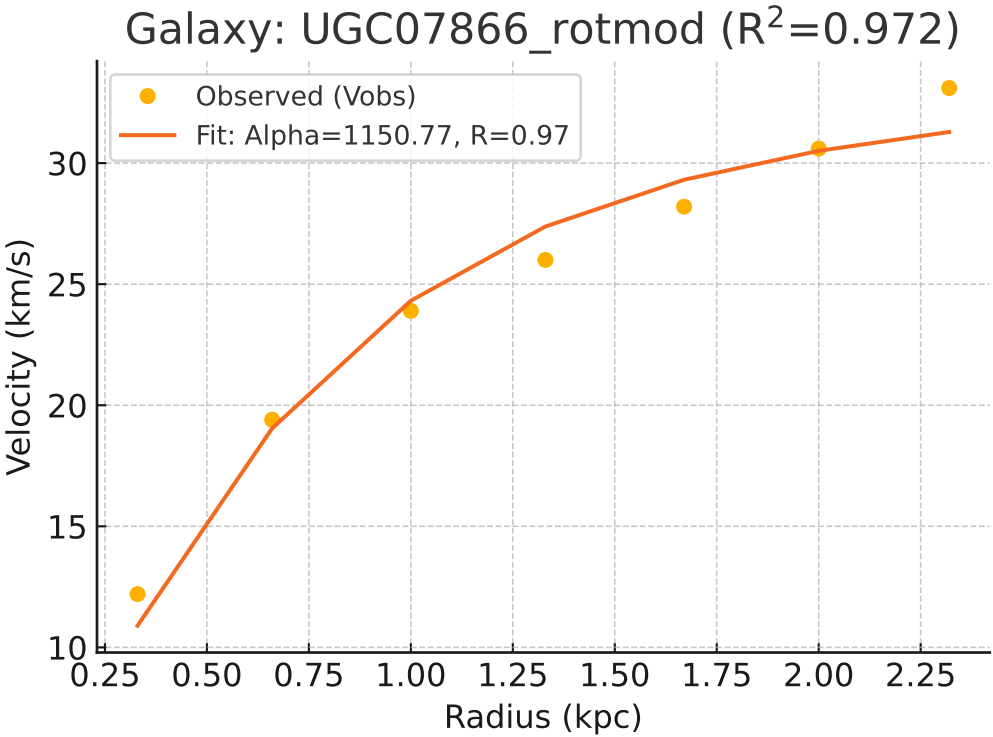

Galaxy: UGC07559_rotmod (R^2=0.997)
Observed (Vobs)
Fit: Alpha=1442.05, R=1.53
Velocity (km/s)
Radius (kpc)
10
15
20
25
30
0.5
1.0
1.5
2.0
2.5

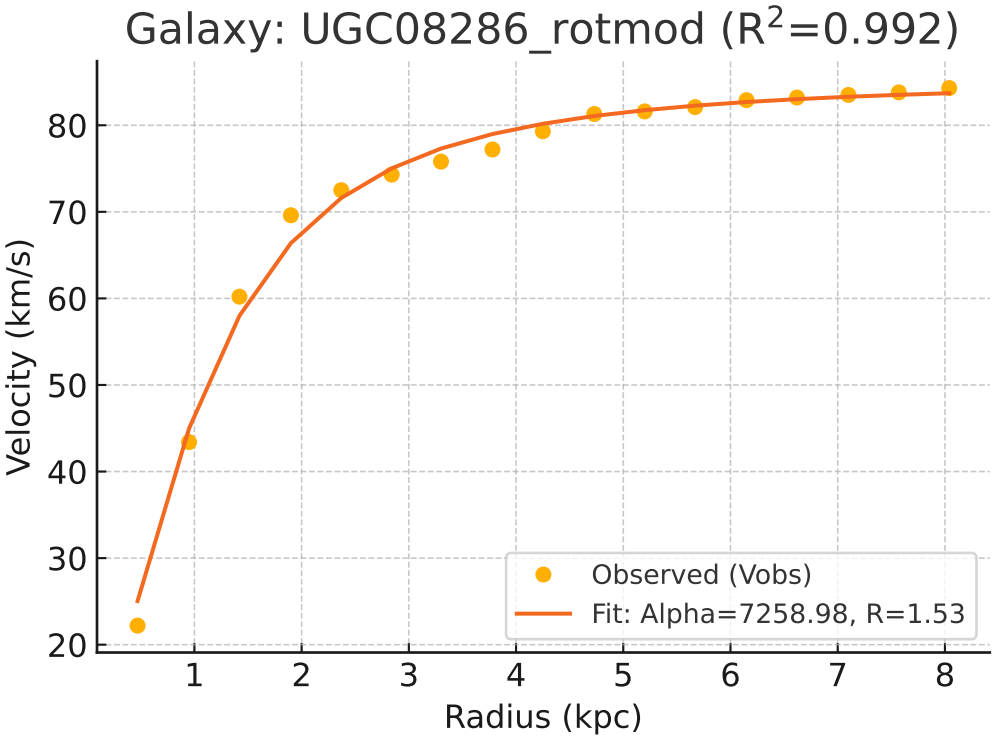

Galaxy: UGC07577_rotmod (R^2=0.983)
Observed (Vobs)
Fit: Alpha=843.38, R=2.29
Velocity (km/s)
Radius (kpc)
2
4
6
8
10
12
14
16
18
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

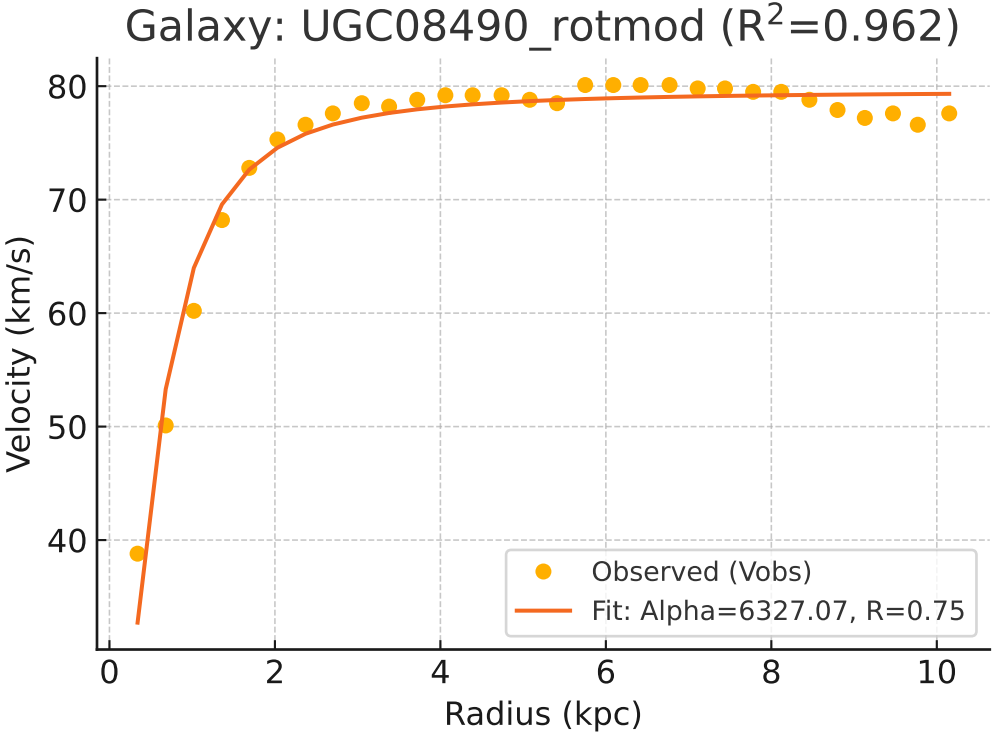

Galaxy: UGC07603_rotmod (R^2=0.990)
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Observed (Vobs)
Fit: Alpha=4410.20, R=1.16

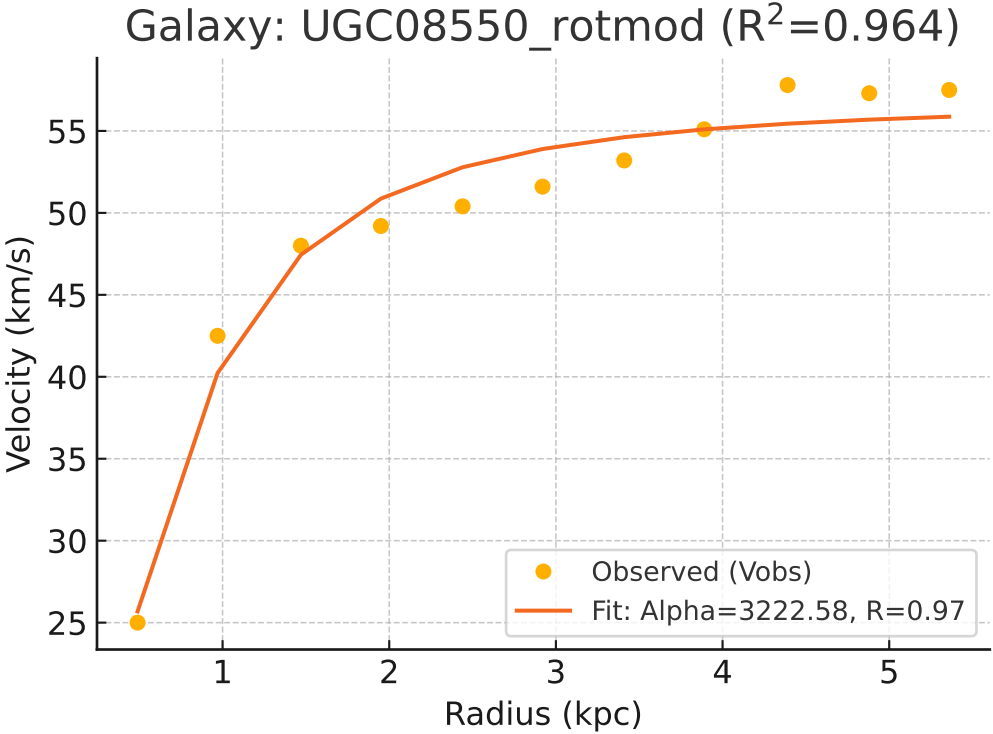

Galaxy: UGC07608_rotmod (R^2=0.993)
Observed (Vobs)
Fit: Alpha=6269.01, R=2.82
Velocity (km/s)
Radius (kpc)
70
60
50
40
30
20
1
2
3
4

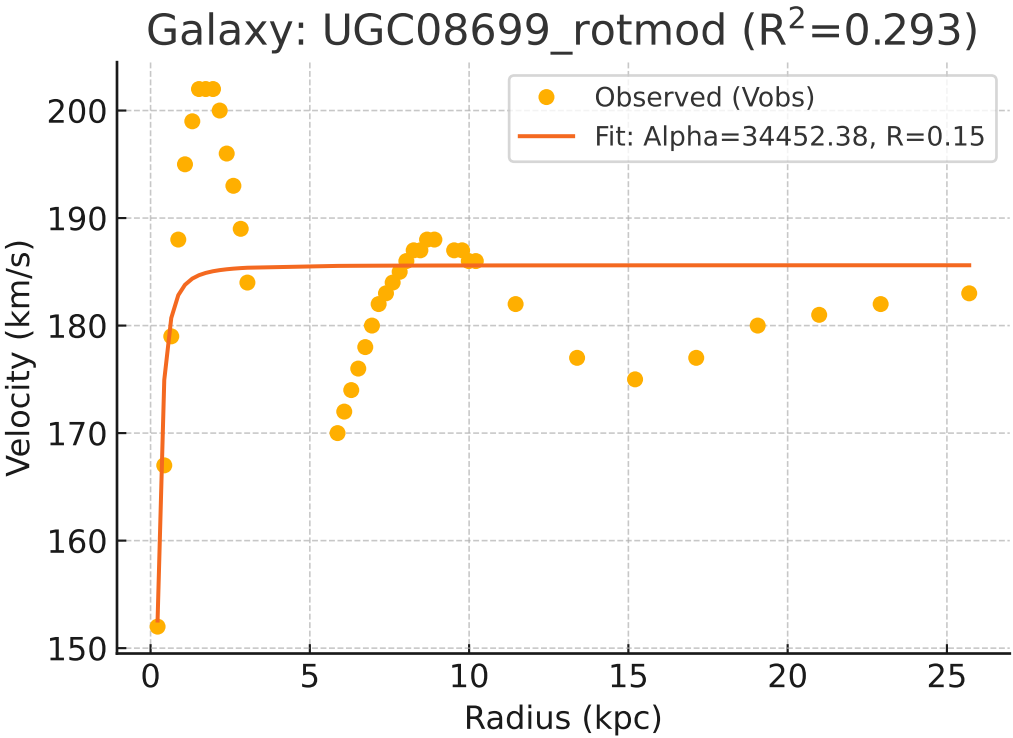

Galaxy: UGC07690_rotmod (R^2=0.710)
Velocity (km/s)
Radius (kpc)
46
48
50
52
54
56
58
60
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Observed (Vobs)
Fit: Alpha=3521.67, R=0.44

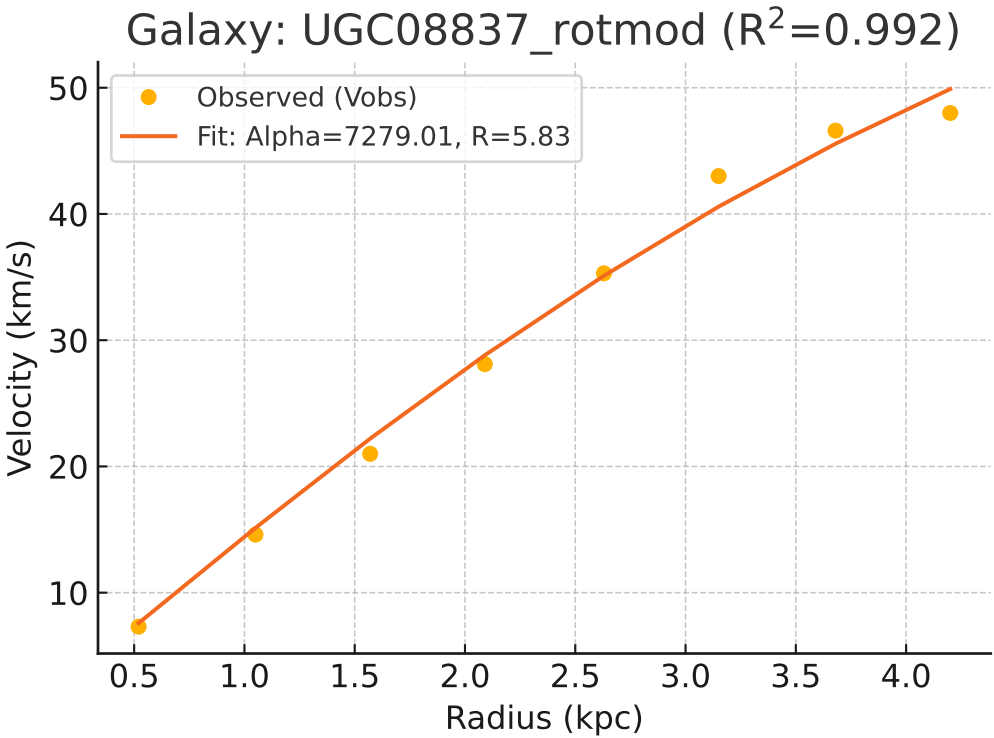

Galaxy: UGC07866_rotmod (R^2=0.972)
Observed (Vobs)
Fit: Alpha=1150.77, R=0.97
Velocity (km/s)
Radius (kpc)
10
15
20
25
30
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25

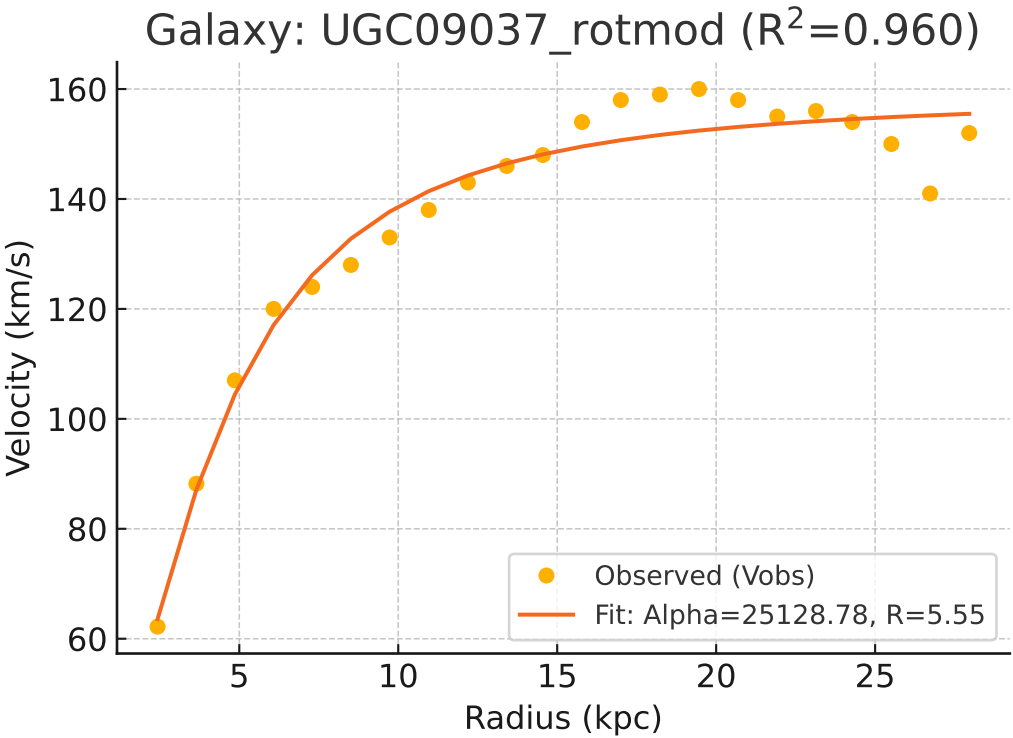

Galaxy: UGC08286_rotmod (R^2=0.992)
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
70
80
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=7258.98, R=1.53

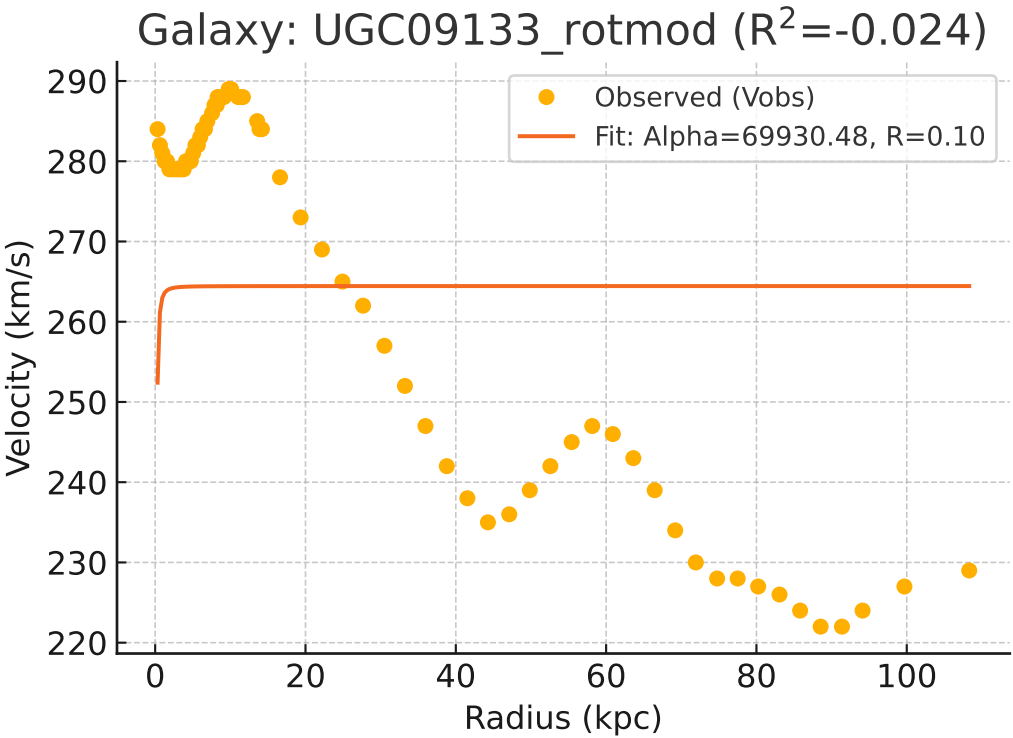

Galaxy: UGC08490_rotmod (R^2=0.962)
Velocity (km/s)
Radius (kpc)
80
70
60
50
40
0
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=6327.07, R=0.75

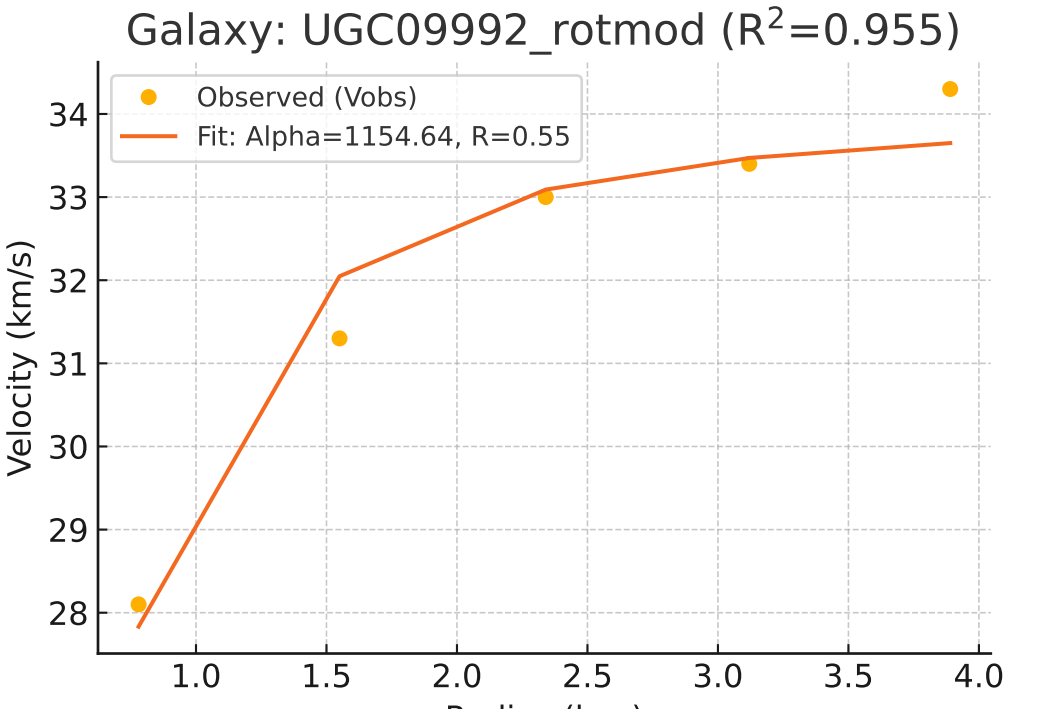

Galaxy: UGC08550_rotmod (R^2=0.964)
Velocity (km/s)
Radius (kpc)
55
50
45
40
35
30
25
1
2
3
4
5
Observed (Vobs)
Fit: Alpha=3222.58, R=0.97

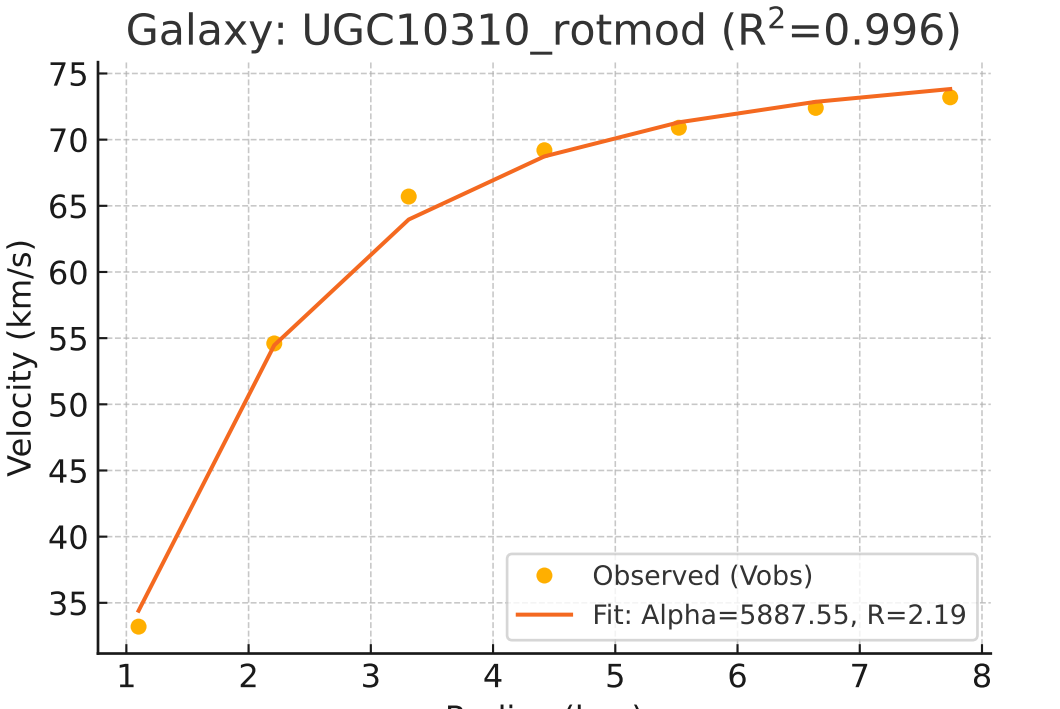

Galaxy: UGC08699_rotmod (R^2=0.293)
Observed (Vobs)
Fit: Alpha=34452.38, R=0.15
Velocity (km/s)
Radius (kpc)
150
160
170
180
190
200
0
5
10
15
20
25

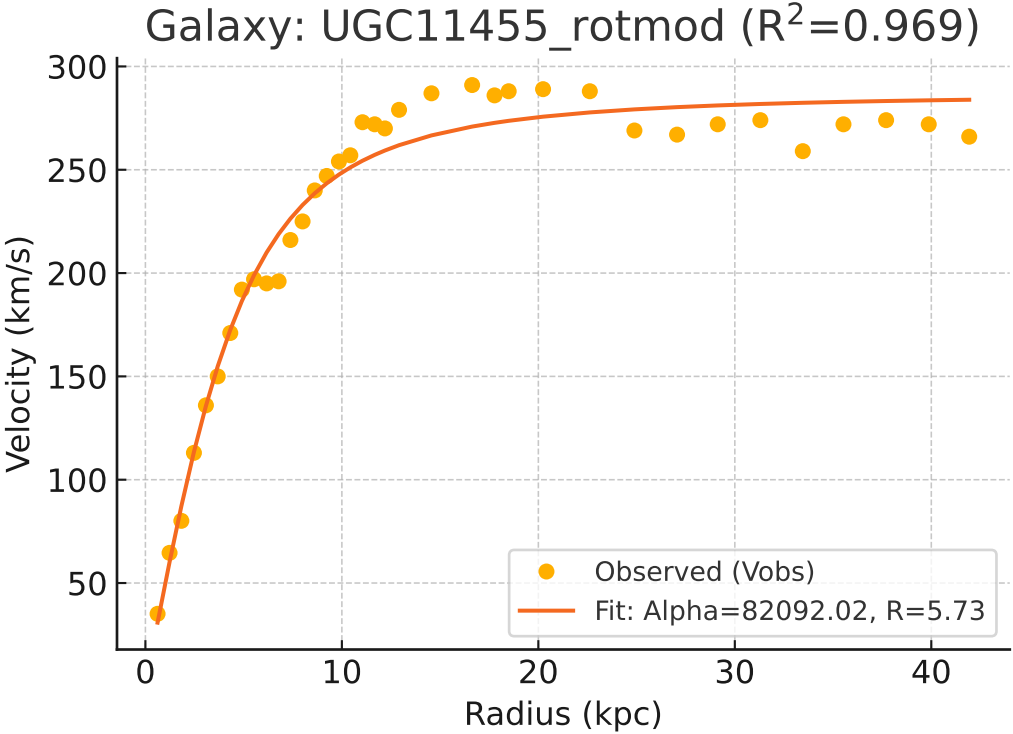

Galaxy: UGC08837_rotmod (R^2=0.992)
Observed (Vobs)
Fit: Alpha=7279.01, R=5.83
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

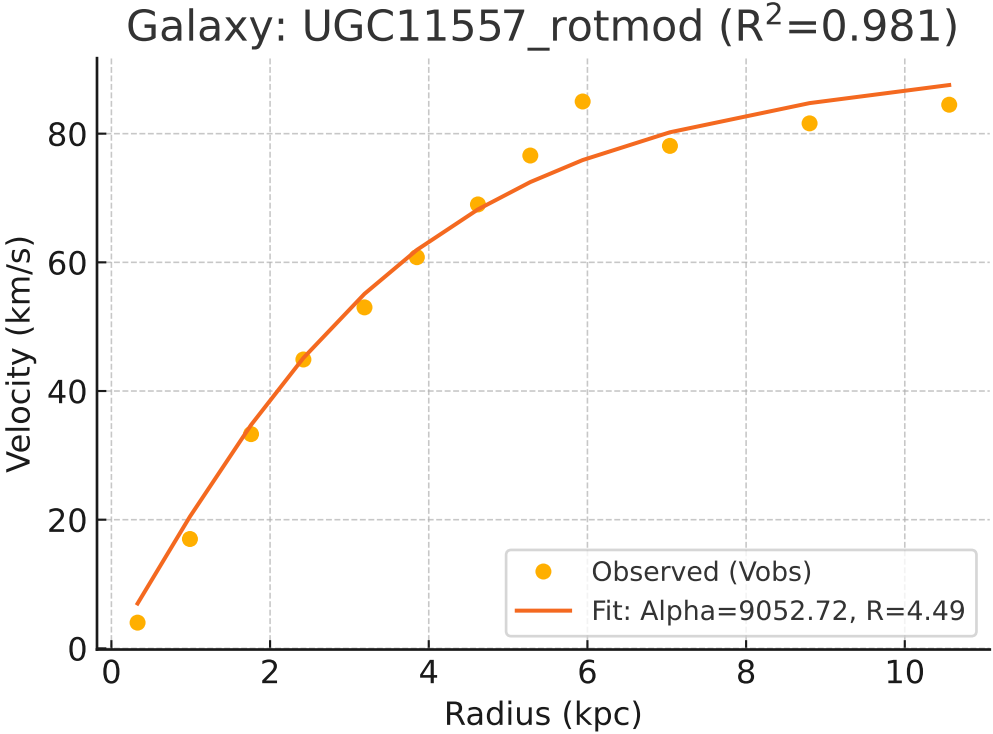

Galaxy: UGC09037_rotmod (R^2=0.960)
Velocity (km/s)
Radius (kpc)
160
140
120
100
80
60
5
10
15
20
25
Observed (Vobs)
Fit: Alpha=25128.78, R=5.55

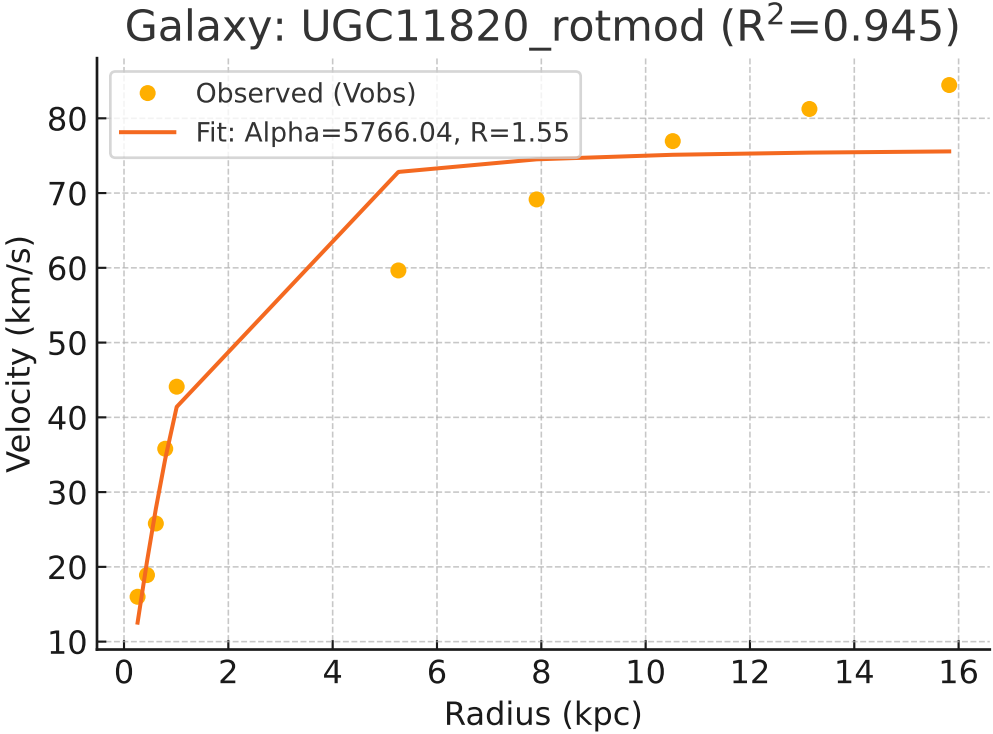

Galaxy: UGC09133_rotmod (R^2=-0.024)
Observed (Vobs)
Fit: Alpha=69930.48, R=0.10
Velocity (km/s)
Radius (kpc)
290
280
270
260
250
240
230
220
0
20
40
60
80
100

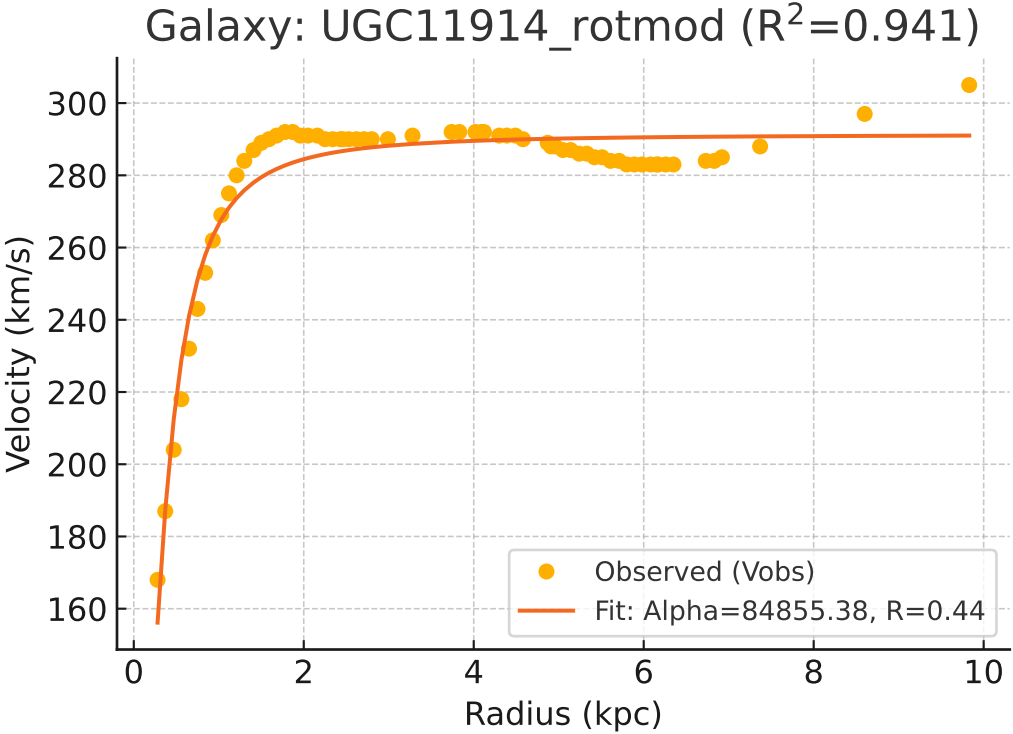

Galaxy: UGC09992_rotmod (R^2=0.955)
Observed (Vobs)
Fit: Alpha=1154.64, R=0.55
Velocity (km/s)
Radius (kpc)
28
29
30
31
32
33
34
1.0
1.5
2.0
2.5
3.0
3.5
4.0

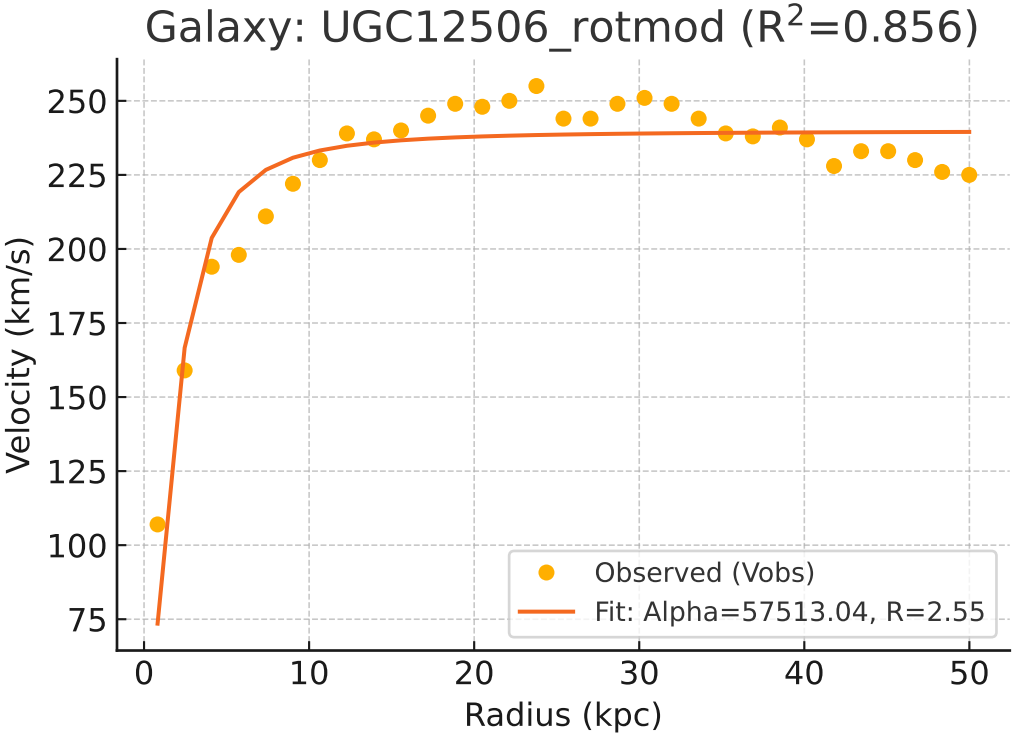

Galaxy: UGC10310_rotmod (R^2=0.996)
Velocity (km/s)
Radius (kpc)
75
70
65
60
55
50
45
40
35
1
2
3
4
5
6
7
8
Observed (Vobs)
Fit: Alpha=5887.55, R=2.19

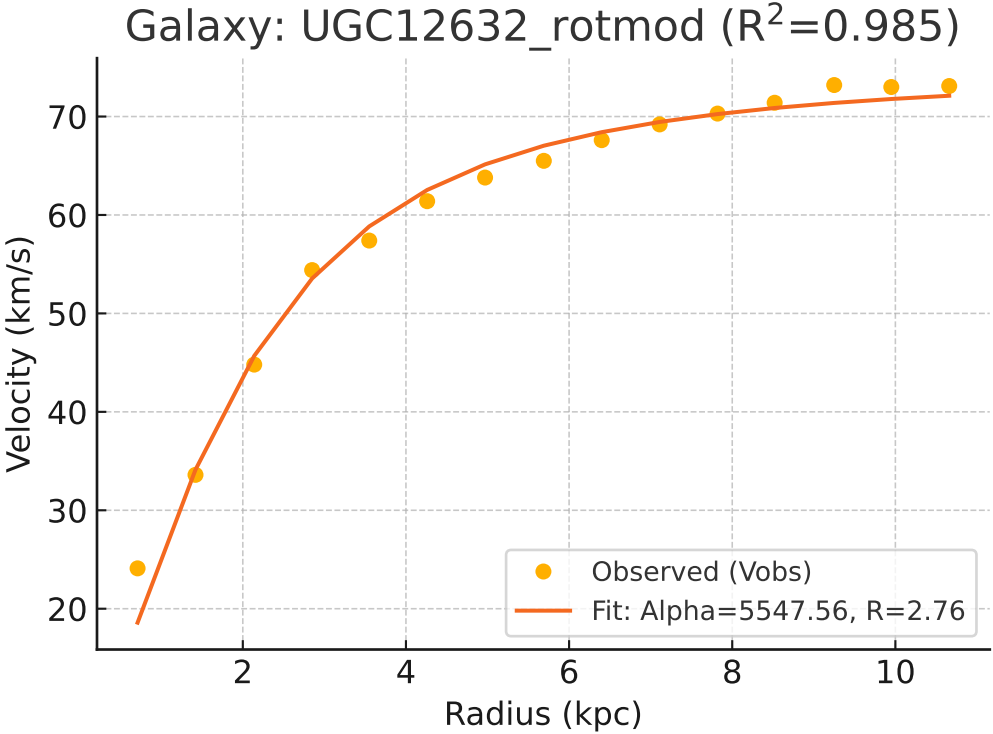

Galaxy: UGC11455_rotmod (R^2=0.969)
Velocity (km/s)
Radius (kpc)
300
250
200
150
100
50
0
10
20
30
40
Observed (Vobs)
Fit: Alpha=82092.02, R=5.73

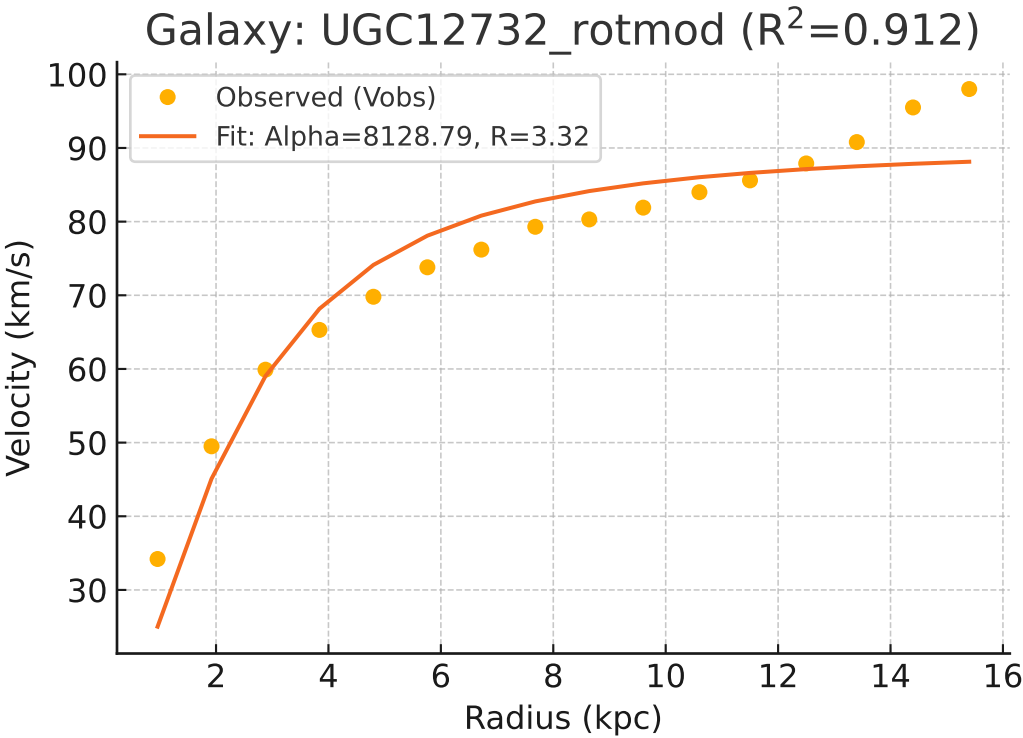

Galaxy: UGC11557_rotmod (R^2=0.981)
Velocity (km/s)
Radius (kpc)
0
20
40
60
80
0
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=9052.72, R=4.49

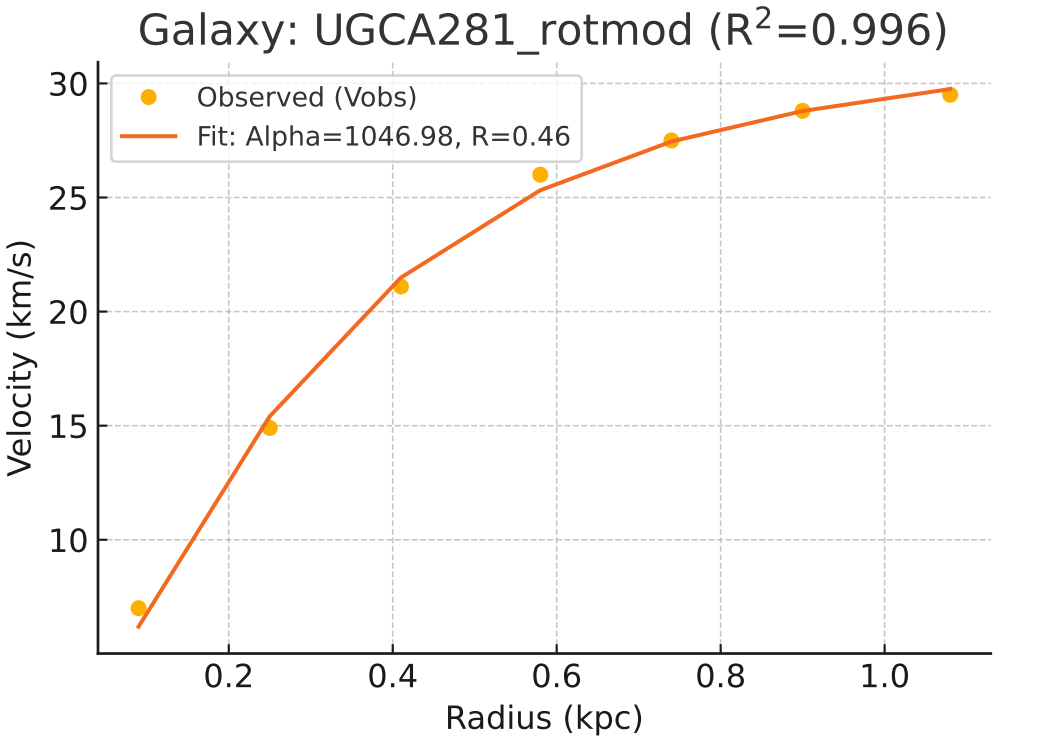

Galaxy: UGC11820_rotmod (R^2=0.945)
Observed (Vobs)
Fit: Alpha=5766.04, R=1.55
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
70
80
0
2
4
6
8
10
12
14
16

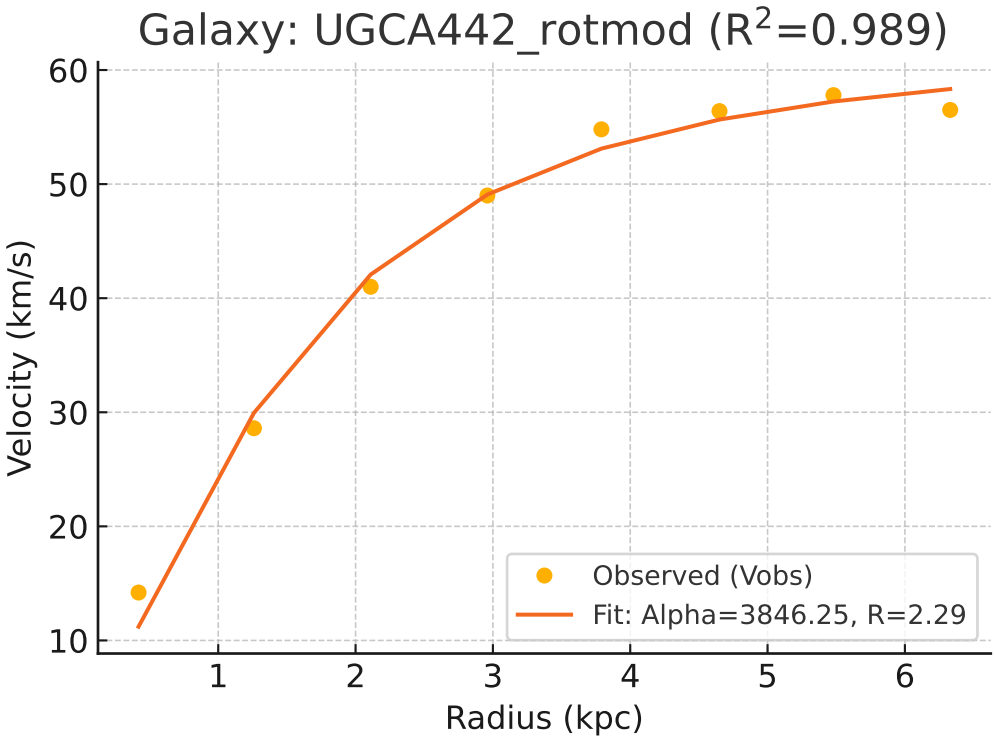

Galaxy: UGC11914_rotmod (R^2=0.941)
Velocity (km/s)
Radius (kpc)
300
280
260
240
220
200
180
160
0
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=84855.38, R=0.44

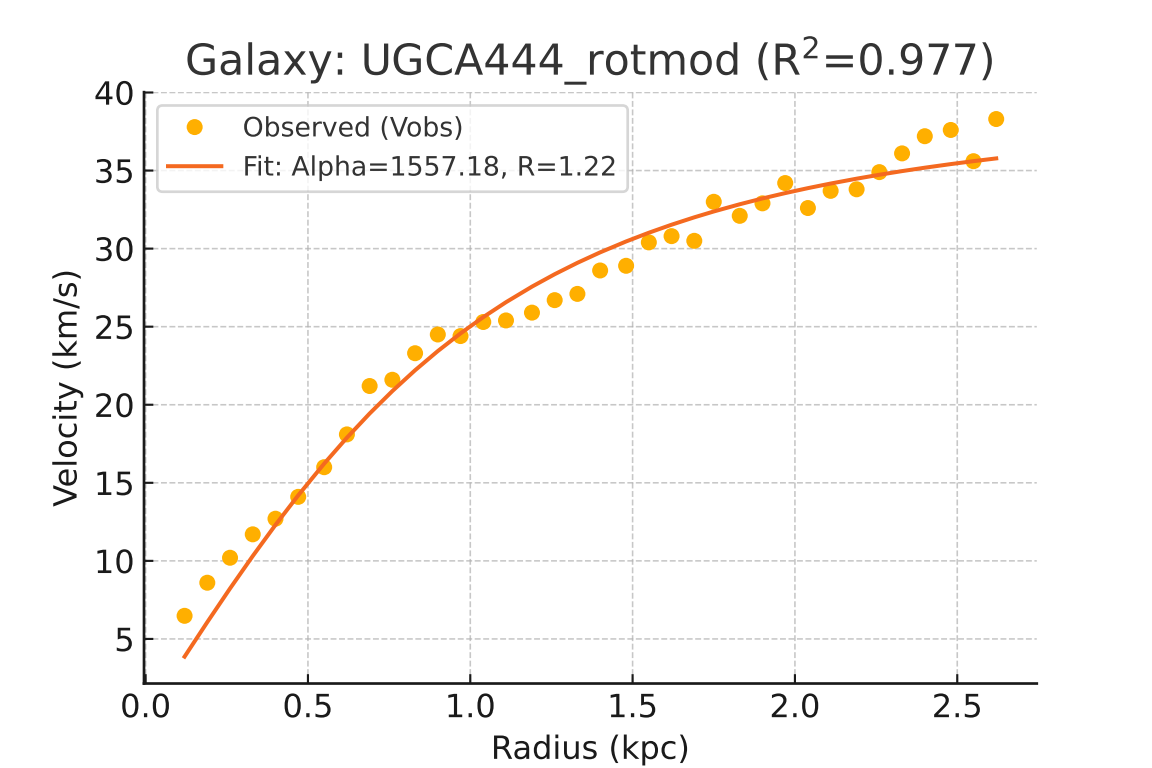

Galaxy: UGC12506_rotmod (R^2=0.856)
Velocity (km/s)
Radius (kpc)
250
225
200
175
150
125
100
75
0
10
20
30
40
50
Observed (Vobs)
Fit: Alpha=57513.04, R=2.55


Galaxy: UGC12632_rotmod (R^2=0.985)
Velocity (km/s)
Radius (kpc)
20
30
40
50
60
70
2
4
6
8
10
Observed (Vobs)
Fit: Alpha=5547.56, R=2.76


Galaxy: UGC12732_rotmod (R^2=0.912)
Observed (Vobs)
Fit: Alpha=8128.79, R=3.32
Velocity (km/s)
Radius (kpc)
100
90
80
70
60
50
40
30
2
4
6
8
10
12
14
16


Galaxy: UGCA281_rotmod (R^2=0.996)
Observed (Vobs)
Fit: Alpha=1046.98, R=0.46
Velocity (km/s)
Radius (kpc)
10
15
20
25
30
0.2
0.4
0.6
0.8
1.0


Galaxy: UGCA442_rotmod (R^2=0.989)
Velocity (km/s)
Radius (kpc)
10
20
30
40
50
60
1
2
3
4
5
6
Observed (Vobs)
Fit: Alpha=3846.25, R=2.29


Galaxy: UGCA444_rotmod (R^2=0.977)
Observed (Vobs)
Fit: Alpha=1557.18, R=1.22
Velocity (km/s)
Radius (kpc)
40
35
30
25
20
15
10
5
0.0
0.5
1.0
1.5
2.0
2.5