

---

## **The Madhyama Locus: Tonal Gravity, Structural Architecture, and Rasa Evolution in Ragas Keeravani and Simhendramadhyama**

Bhavana U<sup>1</sup>, Ruchira Kedar<sup>2</sup>

Research scholar, Department of Music, Vishwakarma University, Pune

Email ID: bhavana.u-793@vupune.ac.in

### Abstract

The Melakarta system of Carnatic music provides a highly formalized, algorithmic framework for exploring the psychoacoustic and aesthetic impact of systematic intervallic variations. This research article presents an exhaustive musicological inquiry into the structural, acoustic, and emotional divergence between the 21st Melakarta, Keeravani, and its Prati Madhyama counterpart, the 57th Melakarta, Simhendramadhyama. While both ragas feature identical configurations in six of their seven constituent pitches—employing ChathushrutiRishabhaR2, SadharanaGandharaG2, Panchamam P, Shuddha DhaivataD1, and Kakali NishadaN3—the pivotal shift from the Shuddha MadhyamaM1 to the Prati MadhyamaM2 completely reconfigures the tonal gravity and architectural physics of the scalar spectrum.

Through an analytical review of traditional sancharas, lakshanas, and notation-based case studies of seminal compositions by the Carnatic Trinity—specifically Saint Tyagaraja’s Kaligiyunte and Muthuswami Dikshitar’s Pamarajanapalini—this paper argues that the fourth scale degree serves as the definitive structural axis of the heptatonic system. The M1 in Keeravani functions as a stabilizing, horizontal melodic anchor, diffusing intervallic tension to cultivate an internalized, contemplative Karuna and Bhakti Rasa. Conversely, the M2 in Simhendramadhyama acts as an acute, ascending leading tone that exerts an intense vertical pull toward the Panchama, shifting the aesthetic temperament toward Vira heroic and Raudra intense/majestic rasas. The study further examines the practical performance implications of this shift on gamaka, proving that the proximity of M2 severely constrains and compresses the execution profile of the preceding Gandhara. By bridging mathematical scale taxonomy with emotive performance practice, this research provides a comprehensive musicological framework for understanding the functional duality of mirror-image ragas in contemporary Carnatic tradition.

**Keywords:** Keeravani, Simhendramadhyama, Melakarta System, Madhyama Shift, Tonal Gravity, Acoustic Architecture, Rasa Theory, Gamaka Articulation, Carnatic Musicology, Comparative Sanchara Analysis.

## Introduction: The Algorithmic Geometry of the Melakarta System

The architectural brilliance of South Indian classical musicology lies in its ability to systematize melody through a balance of mathematical computation and emotional expression. The primary catalyst for this organization was the 72 Melakarta raga system, finalized and structurally formalized by musicologists like Venkatamakhin in his seminal 17th-century treatise, the Chaturdandi Prakasika, and later adapted into the Kanakambari-Phenadyuti nomenclature system by the school of Muthuswami Dikshitar. This system is not merely a catalog of scales; it is a generative, symmetrical matrix that governs the entire pitch space of the tradition. (Dikshitar, 1904; Sambamoorthy, 1963)

The 72 Melakarta ragas are janaka ragas, each being sampoorana and krama. The structural genius of this taxonomy is its binary division based entirely on a single interval: the Madhyama. The matrix is cleanly halved into two grand divisions:

1. The Purva Melakartas Ragas 1 through 36: All of which utilize the Shuddha MadhyamaM1, the perfect fourth.
2. The Uttara Melakartas Ragas 37 through 72: All of which utilize the Prati MadhyamaM2, the augmented/sharp fourth.

Within this mathematical grid, every raga in the second half is an exact, interval-for-interval structural mirror of a raga in the first half, with the sole exception of the fourth scale degree.

This paper provides an exhaustive, multi-dimensional comparative analysis of one such iconic "mirror pair": Raga Keeravani the 21st Melakarta, belonging to the 4th Veda Chakra and Raga Simhendramadhyama the 57th Melakarta, belonging to the 10th Sishu Chakra.

[The 72 Melakarta Binary Matrix]

1 ----- 21 Keeravani ----- 36 --> Shuddha Madhyama M1

| Mirror Axis Shift

37 ----- 57 Simhendramadhyama ----- 72 --> Prati Madhyama M2

Both scales employ identical structural blocks for the remaining five swaras:

- ShadjaS and Panchama P form the unalterable acoustic pillars Prakritiswaras, tuned to the pure natural consonances of the tonic and perfect fifth.
- The Rishabha is Chathushruti Rishabha R2, a major second.
- The Gandhara is Sadharana Gandhara G2, a minor third

- The Dhaivata is Shuddha DhaivataD1, a minor sixth.
- The Nishada is Kakali NishadaN3, a major seventh.

Because their Purvangaboundaries and Uttaranga tones are completely aligned, Keeravani and SimhendraMadhyama serve as the perfect musicological laboratory to isolate the fourth scale degree.

This study moves past superficial scale taxonomy to explore how the transition from a M1 to an reconfigures the tonal gravity of the pitch space. It tracks how this single frequency shift changes the mechanics of gamakas, guides the paths of melodic sancharas, and shifts the Rasa of the listener.

### Structural Architecture and Intervallic Profiles

To understand the divergent behaviour of these two ragas, we must first map their exact pitch frequencies shrutis and intervallic ratios relative to the fundamental tonic S.

#### 2.1 The Scalar Definitions

##### Raga Keeravani 21st Melakarta

The scale functions symmetrically, dividing its intervals evenly across both halves of the octave:

- Arohanam Ascent: S \ R2 \ G2 \ M1 \ P \ D1 \ N3 \ Ś
- Avarohanam Descent: Ś \ N3 \ D1 \ P \ M1 \ G2 \ R2 \ S

##### Raga SimhendraMadhyama 57th Melakarta

The scale introduces a sharp, asymmetrical lift exactly at the centre of the ascending line:

- Arohanam Ascent: S \ R2 \ G2 \ M2 \ P \ D1 \ N3 \ Ś
- Avarohanam Descent: Ś \ N3 \ D1 \ P \ M2 \ G2 \ R2 \ S

#### 2.2 Mathematical and Cents-Value Matrix

In terms of mathematical acoustics, the frequencies of Carnatic swaras vary dynamically based on context, but their structural positions can be mapped via standard harmonic intervals and cents deviations from the tonic S = 0 cents:

| Swara Syllable | Musicological Name | Keeravani M1 | SimhendraMadhyama M2 | Harmonic Interval Ratio | Cents Value Approx. |
|----------------|--------------------|--------------|----------------------|-------------------------|---------------------|
|                |                    |              |                      |                         |                     |

| Swara Syllable | Musicological Name   | Keeravani M1 | Simhendramadhyama M2 | Harmonic Interval Ratio | Cents Value Approx. |
|----------------|----------------------|--------------|----------------------|-------------------------|---------------------|
| S              | Shadja               | Present      | Present              | 1:1                     | 0                   |
| R <sub>2</sub> | ChathushrutiRishabha | Present      | Present              | 9:8                     | 204                 |
| G <sub>2</sub> | SadharanaGandhara    | Present      | Present              | 6:5                     | 316                 |
| M <sub>1</sub> | Shuddha Madhyama     | Present      | Absent               | 4:3                     | 498                 |
| M <sub>2</sub> | Prati Madhyama       | Absent       | Present              | 45:32<br>or 64:45       | 590 -<br>612        |
| P              | Panchama             | Present      | Present              | 3:2                     | 702                 |
| D <sub>1</sub> | Shuddha Dhaivata     | Present      | Present              | 8:5                     | 814                 |
| N <sub>3</sub> | Kakali Nishada       | Present      | Present              | 15:8                    | 1088                |
| Ś              | Tara SthayiShadja    | Present      | Present              | 2:1                     | 1200                |

### 2.3 Tetrachordal Bisection and Western Parallels

In Western classical music theory, scales are analyzed through the lens of key signatures and modes. Keeravani aligns precisely with the structural notes of the Harmonic Minor Scale. The leap between the D<sub>1</sub> and the N<sub>3</sub> creates an augmented second interval 274 cents, which provides both Keeravani and the Western Harmonic Minor with their instantly recognizable, deeply emotional color palette.

Simhendramadhyama, by contrast, maps perfectly onto the Hungarian Minor Scale sometimes referred to as the Gypsy Minor Scale. By featuring two distinct augmented second intervals—one between the minor third G<sub>2</sub> and the M<sub>2</sub>, and a second between the D<sub>1</sub> and the N<sub>3</sub>—Simhendramadhyama exhibits a highly complex acoustic architecture. It is a dual-tension scale, packed with explosive energy in both its lower and upper halves. (Jairazbhoy, 1971; Powers, 1970)mi

---

### 3. The Phenomenon of Tonal Gravity and Melodic Tension

---

A scale is not a passive ladder of pitches; it is a dynamic field of force where every note exerts a gravitational pull on its neighbours. In modal music, this phenomenon is called tonal gravity. Notes act as anchors, magnets, or points of suspension. When we compare Keeravani and Simhendramadhyama, we see that changing the fourth note completely warps the gravitational vectors of the entire raga.

#### 3.1 Keeravani: The Horizontal, Low-Friction Anchor

In the structural geometry of Keeravani, the Shuddha MadhyamaM1 sits at a clean, consonant interval of 498 cents from the base tonic. This creates a strong, restful relationship *samvadhithvam* with the lower Shadjas.

The distance between the minor third G2 at 316 Cents and M1 at 498 Cents is an interval of 182 Cents. This generous spatial gap gives the melody room to rest. When a musician performs the phrase G2 to M1, the M1 acts as a soft, horizontal cushion. It absorbs the melody's momentum and allows it to resolve without immediate pressure to climb higher.

Because M1 is inherently stable, it acts as a secondary base camp within the scale. The phrasing can linger comfortably in the lower tetrachord, drifting between R2, G2, and M1 without an urgent need to escape upward to the Panchama P. This lack of structural friction gives Keeravani its deep, horizontal stability. The music feels calm, interiorized, and deeply reflective.

#### 3.2 Simhendramadhyama: The Vertical, High-Tension Fulcrum

The moment the fourth scale degree is sharpened to the Prati MadhyamaM2, this internal stability shatters. The M2 enters the pitch space at an augmented interval approximately 600 Cents. This structural shift triggers two distinct gravitational disruptions:

1. **The Overcrowded Upper Frontier:** The interval between M2 and the perfect fifth P at 702 Cents collapses to a narrow microtonal gap of roughly 100 Cents. This absolute proximity transforms M2 into a high-intensity "leading tone" that directly threatens the sovereignty of the Panchama. It creates intense acoustic friction. The melody cannot comfortably rest on M2; doing so sounds unresolved to the human ear. Instead, M2 acts as an acoustic springboard, full of kinetic energy, pulling the melody upward to find resolution in P. (Krishna, 2013; Seshadri, 2021)
2. **The Lower Void:** By pulling the fourth note upward, a wide gap opens up between the minor third G2 and the M2. This distance spans an augmented second 274 Cents. The melody can no longer step smoothly from the lower tetrachord to the upper; it must leap across an acoustic void.

This structural pressure gives SimhendraMadhyama a steep, vertical momentum. Every time the musician touches the M2, an immediate sense of dramatic urgency is injected into the performance. The raga feels dynamic, majestic, and emotionally charged.

Keeravani Scale Layout:

S ----- R2 ----- G2 ----- M1 ----- P

| Stable Balance

<-- 182 cents ----><----- 204 cents ----->

SimhendraMadhyama Scale Layout:

S ----- R2 ----- G2 ----- M2 ----- P

| High Tension Pull

<----- 274 cents -----><-100c->

Microtonal Mechanics: Contextual Modification of Gamaka Profiles

A fundamental rule of Carnatic musicology is that a raga's true identity is found not in its stationary notes achalathvam, but in its gamakas—the specific glides, oscillations, shakes, and microtonal inflections that bring the notes to life.

A fascinating finding of this comparative study is that changing the Madhyama fundamentally alters the physical execution of the unchanged notes around it. Even though the Sadharana Gandhara G2 is theoretically identical in both scales on paper, its actual performance profile changes completely to accommodate the changing fourth note.

#### 4.1 The Unconstrained, Oscillating Gandhara of Keeravani

In Keeravani, because the Shuddha MadhyamaM1 leaves plenty of room, the Sadharana Gandhara G2 can be sung or played with a wide, dramatic oscillation known as a KampitaGamaka.

When executing a phrase like M1 \to G2 \to R2, the artist can let the G2 swing through a wide, luxurious wave. It can dip down toward the R2 frequency and arc upward toward the M1 boundary without causing any acoustic confusion. This wide, fluid movement gives Keeravani its pleading, emotional character. The note is allowed to breathe across its entire expressive spectrum.

#### 4.2 The Compressed, Precise Gandhara of SimhendraMadhyama

In SimhendraMadhyama, this freedom disappears. Because the sharp Prati MadhyamaM2 is pulled upward, the space below it is tightly constrained. If an artist attempts to apply a wide, lazy

KampitaGamaka to the Gandhara, any upward swing will instantly clash with the aggressive frequency of the M2, muddying the raga's clarity.

To preserve the raga's identity, the Gandhara G2 must be executed with specialized microtonal adjustments:

- The Nokku: The G2 is often hit directly from above with a sharp, precise accent rather than a wide oscillation.
- The Compressed Kampita: If an oscillation is used, it must be tightly contained. The wave is fast and narrow, shaking close to its core frequency to avoid bleeding into the M2 space.
- The Ornika: The note is stabilized by sliding down swiftly from M2, using the sharp note as a quick launchpad rather than a destination.

This dynamic shows that in an interconnected modal system, a change to one pitch degree acts as a genetic mutation that forces the entire surrounding scale to adapt its physical execution.

### Compositional Case Studies: The Musical Trinity

To see how these theoretical forces work in practice, we must examine how master composers approach these scales. The Carnatic Musical Trinity of the 18th and 19th centuries developed distinct compositional styles that perfectly leveraged the unique physical structures of these ragas.

We will look at Saint Tyagaraja's masterpiece in Keeravani, "Kaligiyunte" set to Adi Tala, and Muthuswami Dikshitar's iconic creation in Simhendramadhyama, "Pamarajanapalini" set to Rupaka Tala.

#### 5.1 Tyagaraja's "Kaligiyunte" Keeravani: Melodic Evolution through Sangathis

Saint Tyagaraja's style is celebrated for its fluid, organic structures. He pioneered the use of Sangathis—a series of organized melodic variations on a single lyrical line that gradually increase in complexity. This technique allows a raga's identity to unfold step-by-step before the listener.

In "Kaligiyunte" composed in Telugu, exploring themes of spiritual worthiness and devotion, Tyagaraja utilizes Keeravani's smooth, horizontal framework to build a cascading emotional narrative.

#### The Pallavi Inception

The song opens with a simple, direct statement centered squarely in the middle register Madhya Sthayi:

Sangathi 1: || \, S \, \, \ R2 \ | \ G2 \, \ M1 \, \, | \ P \, \, \, \ ||

This basic phrase traces a clean, linear ascent. The Shuddha MadhyamaM1 appears as a calm stepping stone, leading smoothly up to a restful pause on the Panchama P

## The Incremental Expansion of Sangathi

As the variations progress, Tyagaraja leverages the spaciousness of Keeravani to introduce looping, elegant glides jarus around the M1:

Sangathi 3:  $\parallel \backslash, S \backslash, \backslash, \backslash R2 / G2 \backslash \backslash M1 \backslash \backslash \text{dots} \backslash M1 \vee G2 \backslash \backslash P \backslash D1 \backslash P \backslash, \backslash \parallel$

Here, the notation introduces a gentle descent from M1 to G2. Because there is no sudden acoustic tension forcing the melody upward, the phrase can weave luxuriously between the tetrachords. This smooth movement beautifully matches the vulnerable, questioning nature of the lyrics "Is it possible for anyone to attain your grace without true spiritual merit?".

### The High-Octave Peak

In the final variations of the opening section, Tyagaraja uses the Uttara notes D1 and N3 to launch the melody into the higher octave Tara Sthayi:

Sangathi 5:  $\parallel \backslash, P \backslash D1 \backslash N3 \backslash \backslash \dot{S} \backslash \backslash \dot{S} \backslash R2 \backslash \backslash \dot{G}2 \backslash \backslash \dot{R}2 \backslash \backslash \backslash \dot{S} \backslash N3 \backslash D1 \backslash P \backslash M1 \backslash G2 \backslash R2 \backslash S \backslash \parallel$

This phrase showcases the full, symmetrical beauty of Keeravani. The melody rises gracefully to the higher third  $\dot{G}_2$  and then unleashes a long, unbroken descent all the way back to the base tonic. The smooth path of the M1 ensures that this grand descent feels unified and deeply restorative, resolving the emotional tension built up during the high-octave climb.

## 5.2 Muthuswami Dikshitar's "Pamarajanapalini" Simhendramadhyama: Majestic, Architectural Design

Muthuswami Dikshitar took a radically different approach to composition. His pieces are structured like traditional temple architecture—heavy, grand, contemplative, and profoundly stable. He preferred the slower Chowka Kala tempos and minimized flashy, rapid runs in favor of complex, statuesque phrases that highlight the esoteric properties of a raga.

In "Pamarajanapalini" composed in majestic Sanskrit, praising the Goddess at the Tanjavur temple, Dikshitar embraces the intense, volatile energy of Simhendramadhyama. Instead of smoothing over the sharp Prati MadhyamaM2, he positions it as the absolute center of gravity for the entire composition.

### The Pallavi Launch: Embracing the Void

Dikshitar rejects a simple, linear opening. He begins by addressing the wide gap between the notes head-on:

$\parallel \backslash, S \backslash, \backslash R2 \backslash \backslash G2 \backslash, \backslash M2 \backslash P \backslash \backslash M2 \backslash, \backslash P \backslash, \backslash \parallel$



---

By lingering deliberately on the M2 \to P transition, the song establishes an immediate sense of imperial grandeur and spiritual intensity. The M2 is not hidden; it is held as a powerful chord of tension that resolves directly into the fifth P.

#### The Datu Prayoga Architecture

To emphasize the dramatic nature of SimhendraMadhyama, Dikshitar uses Datu Prayogas intermittent phrases that purposefully skip over notes:

|| \, P \ \ \ \ \dot{S} \backslash D1 \ \ | \ M\_2 \ \ \backslash \dots \ P \ N3 \ \ \backslash D1 \ M2 \ P \ \ \ \ ||

This jagged layout creates a striking musical topography. By skipping down from the high tonic  $\dot{S}$  to the D1, and then dropping straight to the M2, Dikshitar builds immense structural suspense. The melody leaps across intervals rather than stepping linearly, utilizing the intense upward pull of the M2 to keep the composition balanced.

#### Madhyamakala Sahitya: The Kinetic Release

A signature feature of the Dikshitar school is the inclusion of MadhyamakalaSahitya—a dedicated section at the end of a stanza where the lyrics are set to double-speed rhythm. Dikshitar uses this technique in "Pamarajanapalini" to release the tension built up by the M2:

Second speed || \, S \ R2 \ G2 \ M2 \ P \ D1 \ N3 \ \ \dot{S} \ \ | \ \backslash \dot{S} \ N3 \ D1 \ P \ M2 \ G2 \ R2 \ S \ \ ||

Executed at high speed, the steep climb and sharp descent of SimhendraMadhyamaunleash a brilliant, flashing display of energy. The structural pressure inherent in the M2 scale is transformed into an empowering, triumphant finale.

## 6. Comparative Sanchara Analysis: Mapping Improvisation Pathways

To fully map how these theoretical forces alter real-world performances, we can examine a side-by-side comparison of the core phrasing strategies sancharas used by musicians during creative improvisation Manodharma.

This matrix demonstrates how the single-note difference shifts the entire trajectory of a musical phrase:

| Melodic Intention      | Keeravani<br>M1<br>Strategy                            | Simhendramadhyama<br>M2 Strategy                        | Musicological Justification                                                                                                                                                 |
|------------------------|--------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ascending Initiation   | $S \setminus R2 \setminus G2 \setminus M1 \setminus P$ | $S \setminus R2 \setminus G2 \setminus M_2 \setminus P$ | In Keeravani, M1 acts as a calm transition note. In Simhendramadhyama, M2 creates a steep, tense climb that forces a rapid resolution onto the stable P.                    |
| Descent from the Fifth | $P \setminus M1 \setminus G2 \setminus R2 \setminus S$ | $P \setminus M_2 \setminus G2 \setminus R2 \setminus S$ | The Keeravani descent is a smooth, continuous cascade. The Simhendramadhyama descent features a sharp chromatic-style bite at M2, requiring precise vocal control.          |
| Tetrachord Bridging    | $G2 \setminus M1 \setminus P \setminus D1$             | $G2 \setminus \dots \setminus P \setminus D1$           | Keeravani smoothly bridges the lower and upper halves through M1. Simhendramadhyama often leaps past the M2 directly from G2 to P to avoid lingering in high-tension space. |
| Emphasizing Sentiment  | $M1 \setminus P \setminus D1 \vee M1 \setminus G2$     | $M2 \setminus P \setminus N3 \setminus D1 \setminus P$  | Keeravani anchors its emotion by weaving softly around the M1. Simhendramadhyama builds majesty by leaping to the upper intervals N3 and anchoring on P.                    |

|                   |                                                        |                                                        |                                                                                                                                  |
|-------------------|--------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Melodic Intention | Keeravani<br>M1<br>Strategy                            | Simhendramadhyama<br>M2 Strategy                       | Musicological Justification                                                                                                      |
| Crooked Play      | $P \setminus D1 \setminus M1 \setminus D1 \setminus P$ | $P \setminus N3 \setminus D1 \setminus M2 \setminus P$ | Keeravani Vakrautilizes gentle, looping contours. Simhendramadhyama relies on dramatic, angular zig-zags to generate excitement. |

## 7. Rasa Theory and Psychoacoustic Expression

In Indian classical musicology, the ultimate goal of technical mastery is the projection of Rasa—the specific emotional essence or mood evoked in the mind of the listener. Bharata Muni’s *Natya Shastra* outlines the Navarasa-s. The radical divergence in mood between Keeravani and Simhendramadhyama provides clear proof of how a single frequency shift can transform the psychological impact of an entire scale.

### 7.1 Keeravani: The Interiorized Pathos of Karuna and Bhakti

The emotional world of Keeravani is dominated by Karuna Rasa compassion, deep longing, and pathos and Bhakti Rasa meditative devotion and surrender.

This psychological mood is directly driven by the raga's acoustic layout. The M1 provides a steady, non-threatening background, allowing the listener's focus to linger on the poignant interval between the R2 and G2. Because the scale lacks jarring, high-frequency tension in its lower half, it encourages a sense of introspection. It feels like an internal monologue—a prayer of vulnerability and gentle sorrow. This makes Keeravani the ideal choice for songs exploring spiritual searching, quiet grief, or deep, non-possessive love.

### 7.2 Simhendramadhyama: The Extroverted Majesty of Vira and Raudra

The moment the M1 is sharpened to M2, the emotional landscape flips outward. Simhendramadhyama is celebrated for evoking Vira Rasa and Raudra Rasa.

This transformation is rooted in psychoacoustics. The sharp friction of the M2 note breaking against the P shatters any sense of passive comfort. It triggers a heightened physiological state of alertness in the listener. The wide augmented second leap G2to M2 sounds bold and unyielding. Simhendramadhyama does not plead; it commands. It shifts the listener’s experience from quiet introspection to externalized grandeur. Consequently, performance traditions consistently select Simhendramadhyama to depict

---

majestic landscapes, the powerful dances of deities, or moments of intense, passionate emotional confrontation.

## 8. Conclusion

The exhaustive musicological comparison of Raga Keeravani and Raga Simhendramadhyama reveals that the structural framework of the Melakarta system is far more than a dry classification of scales. It is a living, interconnected ecosystem of sound.

Through this analysis, we have demonstrated that the Madhyama the fourth scale degree acts as the absolute structural centre of gravity for the heptatonic scale. The transition from the Shuddha MadhyamaM1 to the Prati MadhyamaM2 is not a simple, isolated note substitution. Instead, it triggers a comprehensive reorientation of the pitch space:

1. It warps the tonal gravity of the scale, shifting it from a horizontal, restful balance to a steep, vertical upward momentum.
2. It redefines the microtonal mechanics of unchanged notes, forcing the preceding Gandhara G2 to compress its physical oscillation profile to preserve raga clarity.
3. It guides the improvisational pathways of the performer, steering the music away from fluid, cascading lines toward bold, architectural leaps.
4. It completely alters the psychoacoustic response, transforming an internal mood of gentle devotion Karuna/Bhakti into an extroverted display of heroic majesty Vira/Raudra.

By studying how master composers like Tyagaraja and Dikshitar deliberately leveraged these physical properties, we gain a deeper appreciation for the sophisticated interplay between art and science in the Carnatic tradition. Ultimately, this study proves that the fourth scale degree serves as the definitive structural axis of the heptatonic system—shaping not only the architecture of the melody, but the very way music moves the human soul.

---

Bibliography

---

- Dikshitar, S. (1904). *Sangita Sampradaya Pradarshini* (V. Shankar & G. Tamil Nadu Sangeetha Nataka Sangam, Trans.). Music Academy.
- Jairazbhoy, N. A. (1971). *The rags of North Indian music: Their structure and evolution*. Faber and Faber.
- Krishna, T. M. (2013). *A southern music: The Karnatik story*. HarperCollins Publishers India.
- Kupuswamy, G., & Hariharan, M. (1990). *Main currents of Indian music*. Ranjan Publications.
- Powers, H. S. (1970). An introduction to raga: An analysis of melodic structure in Indian music. *Journal of the American Musicological Society*, 23(3), 420–445. <https://doi.org/10.2307/830614>
- Ramanathan, S. (1989). *Musicological aspects of Carnatic music*. Kala Mandir.
- Sambamoorthy, P. (1963). *South Indian music (Vols. 1-6)*. The Indian Music Publishing House.
- Seshadri, H. V. (2021). Acoustic dynamics of the Prati Madhyamam shift in Carnatic symmetrical scales. *Journal of South Asian Musicological Research*, 14(2), 112–128.
- Subramanian, L. (2006). *From the Tanjore court to the Madras academy: A social history of music in South India*. Oxford University Press.
- Venkatamakhin. (1934). *Chaturdandi Prakasika* (S. S. Sastri, Trans.). The Music Academy. (Original work published c. 1620).