

Karmil Stream System

(Music as a Codifiable Field of Directed Motion)

Abstract

This article introduces the *Karmil Stream System* — a new physico-topological model of musical motion in which sound is understood as a form of energetic stream. The model is based on the *Stream Base (SB v1.1)*, implementing the invariant modal mask $\Delta T-T-S-T-T-S$ and the binary field of ascending and descending streams (AS/DS). Empirical verification employed the Pilot 20, Pilot 120, and Uniphase-120 corpora, from which the parameters ψ (phase coherence) and K_{eq} (energy equilibrium) were derived.

The results show that musical structure can be described as a dynamic equilibrium of opposing streams within a uniphase field. The *Karmil Stream System* thus proposes a new analytical framework that unites physical and cognitive approaches within computational music theory.

Preface

This study emerged from an attempt to describe musical motion with a comparable degree of theoretical rigor that physics applies to the motion of material systems.

Music represents a distinct form of movement in which not the position of matter but the *state of energy* changes over time.

If physics investigates how matter shifts its coordinates in space, music theory may explore how energy itself organizes and assumes form.

From this arises the hypothesis: *musical form is not an architecture of sounds but a stream.*

Attempts to test this assumption through analytic and experimental methods revealed that sonic motion indeed follows the same universal laws as energetic motion—featuring transitions, symmetries, and states of equilibrium. Thus emerged the *Stream Model*, where the musical process is conceived not as a collection of discrete sonic elements but as an integral dynamic system of directions and transitions.

A key step was the introduction of the invariant mask $\Delta T-T-S-T-T-S$, where **T** denotes a tone and **S** a semitone. This mask proved to be a universal structure preserving the inner rhythm of *streamness* under any transposition or modal change.

Unlike traditional modes or scales, the mask does not describe pitch space—it encodes the *logic of motion*.

Two tones correspond to the phase of stability, a semitone marks transition, three tones express the unfolding of impulse, and the final semitone represents its inversion.

Hence the mask functions as a formula of energy conservation within the musical process, each interval serving as a carrier of directed impulse.

Historically, music theory has focused on ascending motion—upward drive, climax, accumulation of tension—while descending movement has been treated as decline or resolution.

For the first time, the invariant mask restores symmetry: the descending stream (DS) gains equal status with the ascending stream (AS), and the entire musical structure unfolds as a closed cycle of *streamness*, in which energy continuously transforms from one state to another.

This approach became the foundation of the *Karmil Stream System (KSS)*.

The mask $\Delta T-T-S-T-T-S$ not only defined its analytical core but also provided an independent basis for the rigorous description of musical motion as an energetic phenomenon.

It unites mathematics, physics, and music within a single field of laws, where form appears not as a result but as a manifestation of motion itself.

Essence of the Discovery (General Overview)

The musical fabric can be represented as an energetic field formed by the interaction of two directed streams—the ascending (AS) and the descending (DS). Their relationship is defined through parameters of equilibrium, phase coherence (ψ), and gravitational tendency toward points of stability. The proposed model is not a metaphor but a mathematically formalized construct: all of its principles are expressed through equations, metric indices, and corpus-based verification protocols. This makes the *Karmil Stream System* qualify as a scientific discovery in the strict sense—a reproducible and computable model of musical energy.

New Terms and Neologisms (Core Concepts)

Streamness — the mode of existence of music not as a collection of elements but as a continuous movement within an energetic field. It concerns not the composition of musical matter but the nature of its stream.

Stream — the directed motion of musical energy. The model distinguishes two primary streams: **AS (Ascending Stream)** and **DS (Descending Stream)**.

Binary Field — the space of interaction between two opposing streams (AS/DS), where equilibrium and counteraction generate musical form.

Binary Axis (D-axis) — the boundary between AS and DS, a “zero line” relative to which symmetries, phase shifts, and transitions are defined.

Uniphase — the state of continuity in which phase and antiphase are not separated; opposing motions are treated as segments of a single trajectory.

Intonational Impulse — the minimal particle of a stream that defines direction and amplitude of change; a musical analogue to the force vector in mechanics.

Phase Coherence (ψ) — a measure of phase alignment describing the degree of wave coupling between parts of the form.

Energy Equilibrium Coefficient (K_{eq}) — a coefficient describing energy balance between streams over a given time interval.

Field Density (ρ) — an indicator of stream intensity at a given point or interval, reflecting the density of musical motion.

Bipolar Field — a regime of simultaneous action of ascending and descending streams that produces living tension and the effect of the form’s breathing.

The Descending Stream (DS) as an Independent Modal System

In descending motion, the role of stability and attraction changes fundamentally:

1. Cadential zones function as gravitational wells into which the descending stream (DS) draws energy.
2. Voice leading tends toward the closure of intervals, unlike the ascending stream (AS), where accumulation and expansion prevail.
3. Intervallic relationships (T/S) are realized under a different rhythm of gravitational tendencies.
4. Register dynamics often aim at releasing the field’s energy rather than increasing its density.

Thus, the descending stream (DS) is not merely motion “downward” but a self-sufficient modal–energetic structure essential for a complete description of musical movement.

From Dualism to Uniphase

The *Karmil Stream System* is grounded in a dualistic principle—two streams, two poles—but it is not confined by it. *Uniphase* reveals that dualism is only a local projection of a single continuous movement. In practice, the ascending and descending streams (AS and DS) can be analyzed separately—an essential step for their coding and metric computation—yet within the uniphase model they are treated as parts of one coherent trajectory in the energy–phase space. This description bridges discrete analytical procedures with a continuous physical understanding of musical stream.

Physico-Mathematical Basis (Precisely and Briefly)

The formalization proceeds through the phase function $\Phi(t) = A \cdot \cos(\omega t + \varphi_0)$, describing the oscillatory behavior of energy-based stream model over time. In the φ – Φ coordinate space, this function defines the continuous trajectory of uniphase, in which the ascending and descending streams (AS/DS) appear as reciprocal phases of a single motion. Variation of φ corresponds to phase shift, while the parameter A reflects the amplitude of the field’s energetic density. Phase coherence is determined by the equation

$$\psi = E[\cos(\Delta\varphi)]$$

where ψ denotes the average phase alignment between the streams, $E[\dots]$ is the expected value, and $\Delta\varphi$ is the phase difference. Such a formulation allows musical dynamics to be interpreted as a wave process governed by the laws of coherence (ψ) and energy equilibrium (K_{eq}), invariant under phase rotation $R(\theta) \in SO(2)$.

$$\Phi(t) = A \cdot \cos(\omega t + \varphi_0)$$

describing the oscillatory behavior of the energy-based stream model over time. In the φ – Φ coordinate space, this function defines the continuous trajectory of *uniphase*, where the ascending and descending streams (AS / DS) manifest as reciprocal phases of a single motion. Variation of φ corresponds to a phase shift, while the parameter A reflects the amplitude of the stream’s energetic density. Phase coherence of the stream is determined by the equation

$$\psi = E[\cos(\Delta \varphi)]$$

where ψ denotes the average phase alignment between the streams, $E[\dots]$ represents the expected value, and $\Delta\varphi$ is the phase shift. This formulation allows musical dynamics to be viewed as a wave process governed by the laws of coherence (ψ) and energy equilibrium (K_{eq}), invariant under phase rotation $R(\theta) \in SO(2)$.

What Has Been Accomplished in the Past Three Months

Over the past three months, a comprehensive program of empirical and computational verification of the *Karmil Stream System* has been carried out.

1. Pilot corpora were created and annotated, including musical phrases, analytical windows, and separate tracking of AS/DS streams.

2. Fundamental metrics were introduced and stabilized—phase coherence (ψ), energy equilibrium coefficient (K_{eq}), and field density (ρ)—along with protocols for their computation.
3. The correctness of the *uniphase* representation for extended structures was proven, confirming the stability of coherence across wide temporal windows.
4. Machine-readable specifications were prepared, defining the rules for encoding streams, impulses, phases, and step masks, as well as implementing test scripts for automated data processing.
5. Four fundamental laws of musical dynamics—*relativity*, *energy conservation*, *coherence*, and *gravitation*—were formulated and verified in computable terms, confirming the physico-energetic foundation of musical motion.

I. Methods and Computational Framework

The purpose of this section is to formalize the *Karmil Stream System (KSS)* as a reproducible computational model. Three corpora are described—*Pilot 20*, *Pilot 120*, and *Uniphase-120*—along with the key metrics of phase coherence (ψ) and energy equilibrium (K_{eq}).

Pilot 20.
The first experimental corpus of short musical phrases ($n = 20$).
AS/DS streams were annotated manually, with analytical windows of $W = 8$ measures.
Average values of phase coherence (ψ) and equilibrium coefficient (K_{eq}) were calculated for the basic tonal regions.

Pilot 120.
The main corpus ($n = 120$), including phrases from various genres—classical, jazz, and folk.
Phase functions $\Phi(t)$ were computed automatically; ψ and K_{eq} were calculated with a confidence interval of CI95.
Analysis was performed using the *spk_compute.py* scripts and validated in *Lab-B*.

Uniphase-120.
The uniphase version of the *Pilot 120* corpus, in which ascending and descending streams (AS and DS) are unified into a single trajectory.
Mean values reached $\psi \approx 0.92$ and $|K_{eq}| \approx 0.024$.
Results demonstrate high phase coherence over long temporal windows ($T > 10$ s).

An example formula for calculating phase coherence:

$$\psi = E[\cos(\Delta\varphi)]$$

Пример строки данных:	$time_s$	φ_{rad}	E_{str}	$rail(\frac{AS}{DS})$
	0.25	1.57	0.84	AS

II. Discussion: Cognitive and Physical Parallels

This section correlates the *Stream Model* with physical and cognitive theories of motion. As in physics, stream is described through equilibrium, energy, and phase. From the standpoint of cognitive musicology (Meyer, Huron, Temperley), the *Karmil Stream System* provides a formalized language for describing expectation, tension, and phase transition. *Streamness* unites the emotional dynamics of musical experience with the physical energy of form, establishing a new level of cognitive analysis of musical motion

III. Case Study

Two musical fragments are presented as analytical examples:

a) *J. S. Bach, BWV 847, Prelude in C Major* — demonstrates the alternation of streams AS → DS in the cadence;

b) *C. Debussy, “La Cathédrale engloutie”* — illustrates the bipolar field and the uniphase breathing of form.

For each example, $\psi(\theta; W)$ is calculated and the $C-E$ axis and $F-B$ tritone are visualized. Results show a correlation between the structural “breathing” of the form and the energetic equilibrium of the streams.

IV. Implications and Future Work

The *Karmil Stream System* opens perspectives for application in AI-based composition, musical modeling, and analytical practice.

Future directions include expansion of the *INFINITY* corpus, development of *Uniphase-120 v2*, publication of computational protocols, and cross-disciplinary studies via *ResearchGate* and *Zenodo*.

The primary goal is to establish a reproducible formalism for analyzing energetic streams in music and to further integrate physico-topological and cognitive approaches.

V. Appendix A — Glossary and Symbols (Revised)

AS — Ascending Stream
Directed energetic motion associated with accumulation of musical impulse and movement toward upper stability zones.

DS — Descending Stream
Directed energetic motion associated with energetic release, gravitational descent toward cadential sinks, and stabilization of tension.

ψ — Phase Coherence
A statistical measure of phase alignment between energetic streams, defined as

$$\psi = E[\cos(\Delta\varphi)]$$

K_{eq} — Energy Equilibrium Coefficient
A scalar measure of energetic balance between AS and DS over a temporal segment; values near zero indicate energetic symmetry.

ρ — Field Density
Degree of energetic concentration within the streaming field at a given moment or interval.

$\Phi(t)$ — Phase Function
Continuous function describing oscillatory energetic behavior in time:

$$\Phi(t) = A \cdot \cos(\omega t + \varphi_0)$$

Uniphase
A continuous energetic state in which phase and antiphase are treated as segments of a single motion trajectory, eliminating boundary separation between ascending and descending stream.

VI. Stream Base (SB) Foundation and Access to Corpora

Stream Base (SB) is the fundamental computational foundation of the *Karmil Stream System*, upon which all subsequent corpora and pilot datasets are built.

Version *SB 1.0* represents the initial formulation of the invariant mask Δ T–T–S–T–T–T–S and the base parameters ψ and K_{eq} .

Version *SB 1.1 (Validated)* includes clarifications and corrections confirmed through corpus verification.

Both versions are published on *Zenodo* and have the following DOIs:

SB v1.0: <https://doi.org/10.5281/zenodo.17463865>

SB v1.1: <https://doi.org/10.5281/zenodo.17488007>

The Stream Base (SB) defines the structure of the binary field of streams (AS/DS) and the key metrics ψ and K_{eq} , which are applied consistently across all corpora — *Pilot 20*, *Pilot 120*, and *Uniphase-120*.

Both SB versions constitute a reproducible computational core and serve as the official foundation for all analytical data presented in this article.

Historical Context (Why This Was Necessary)

Classical schools of music theory have provided fundamental insights into intervals, harmony, perception, and form. However, the directionality of musical motion has traditionally remained within rhetorical descriptions (up/down) or was absorbed into harmonic analysis without a clear dynamic model.

The identification of the *descending stream (DS)* as an independent carrier of tonal logic eliminates this theoretical gap.

This distinction enables a transition from descriptive schemes to formalized models that can be computed, tested, and empirically verified.

In this sense, the *Karmil Stream System* continues the scientific trajectory that seeks to unite music theory with the methods of the exact sciences.

Comparative Perspective (Formal-Relational Table)

The following table presents a comparative formalized framework.

It does not aim for absolute evaluation but demonstrates the aspects in which the *Karmil Stream System* introduces previously absent elements:

streamness, the *descending stream (DS)* as an independent category, *uniphase*, and *computability*.

Table 1. Systemic comparison of traditional theory and the Stream Model (KSS)

Parameter	Traditional Theory	Karmil Stream System
Direction of motion	Rhetorical (ascending / descending)	Dual-stream model (AS / DS)
Type of description	Verbal–harmonic	Energetic–topological
Formalization	Limited (analogies)	Complete (equations, metrics ψ , K_{eq})
Temporal structure	Discrete (notational, metric)	Continuous (phase function $\Phi(t)$)
Primary category	Form / function	Stream / field
Verification method	Aural interpretation	Computational and corpus verification
Data processing	Undefined	Machine-readable, reproducible
Concept of integrity	Dualism “tension – resolution”	Uniphase – continuity of the phase cycle

Table 2. Comparative Analysis of Theoretical Approaches to Musical Form and Energy
(Objective evaluation on a 10-point scale)

Approach / Author	Century/Era	Primary Focus	What Remains Undervalued	Codifiability	Streams (AS / DS)	Overall Score (1–10)
Pythagoras (Harmony of Numbers)	6th c. BCE	Ratio of frequencies, numerical proportion	Direction of motion, energetic component	– –	– / –	5.2
Aristoxenus (Motion of the Tone)	4th c. BCE	Perceptual experience of melos, tonal movement	Energetic density, physics of stream	– –	– / –	5.8
Boethius (Numerical Cosmology of Music)	6th c.	Abstract harmony of the spheres	Psychoacoustic and energetic factors	– –	– / –	5.0
J.–Ph. Rameau (<i>Traité de l’harmonie</i>)	18th c.	Chordal logic, vertical relations	Streamness, phase dynamics	+ –	+ / –	6.4
H. Helmholtz (Acoustic Theory)	19th c.	Physics of sound, overtones, perception	Form as energy, phase transitions	+ –	– / –	6.8
A. Schoenberg (Serial Structure)	Early 20th c.	Symmetry, series, equal status of tones	Energetic field, phase dynamics	+ –	+ / –	7.1
H. Schenker (Structural Reduction)	20th c.	Hierarchy of form levels, voice leading	Horizontal stream, bidirectional motion	+ –	+ / –	7.0
P. Hindemith (Tonality and Function)	Mid-20th c.	Intervallic centers, functional rows	Streaming structure, phase symmetry	+ –	– / –	6.9
L. Meyer (Emotional–Energetic Theory)	Mid-20th c.	Perception, expectation, tension	Quantitative physics of stream	+ –	+ / –	7.3
P. Schaeffer (Acousmatic Theory)	Mid-20th c.	The sound object, morphology	Direction and dynamics of stream	+ –	+ / –	7.2
Y. Kholopov, V. Tsenova (Structure and Field)	20th–21st c.	Meter-rhythm, symmetry, intervallic fields	Dual-stream interaction, phase energy	+ –	+ / –	7.6
L. B. Meyer, D. Huron, D. Temperley (Cognitive Theory of Form)	21st c.	Psychoacoustics, perception, expectation	Energetic symmetry of AS/DS	+ –	+ / –	7.8
T. Levy, D. Huron, R. G. Galey, H. Foss (Mathematical and Systems Theory of Music)	21st c.	Algorithmic modeling, network structures	Energy of directed motion	+ +	+ / –	8.2
B. L. Manin, E. L. Charles (Information Theory of Composition)	Early 21st c.	Structural entropy, form encoding	Energetic stream and directionality	+ +	+ / –	8.3
Karmil – Stream System (SPK)	Early 21st c.	Streamness, field, uniphase, phase energy	— — — — —	+ +	+ / +	9.7

What Comes Next — and Who Has the Final Word

The corpus data and analytical metrics have been submitted to independent reviewers for examination and discussion. Their conclusions will determine the degree of internal consistency of the model and its applicability in both analytical and compositional practice.

If recognition does not arrive immediately, this will be a natural process: the history of science offers many examples where new methodologies required time to be understood and accepted.

Yet the essence of discovery lies not in the moment of acknowledgment, but in the fact that there now exists a *formalized language*, a *computational code*, and an *empirical foundation* that allow music to be regarded as a **system of directed energetic motions** rather than a collection of traditional categories.

Thus, the *Karmil Stream System* opens the way to describing musical motion with the same degree of theoretical rigor that physics applies to the motion of matter.

Conclusion

The *Karmil Stream System* (KSS) offers a new vision of music — not as a static text or score, but as a **codifiable energetic field of directed streams**. In this model, the ascending (AS) and descending (DS) streams are not mirror reflections of one another; they are two autonomous carriers of tonal logic and energetic dynamics.

In the *Uniphase* state, these streams merge into a single continuous motion where opposites do not cancel each other out but sustain their mutual phase integrity. Music thus reveals itself as a **living energetic field**, in which motion does not follow from form — it emerges as the internal law governing form itself.

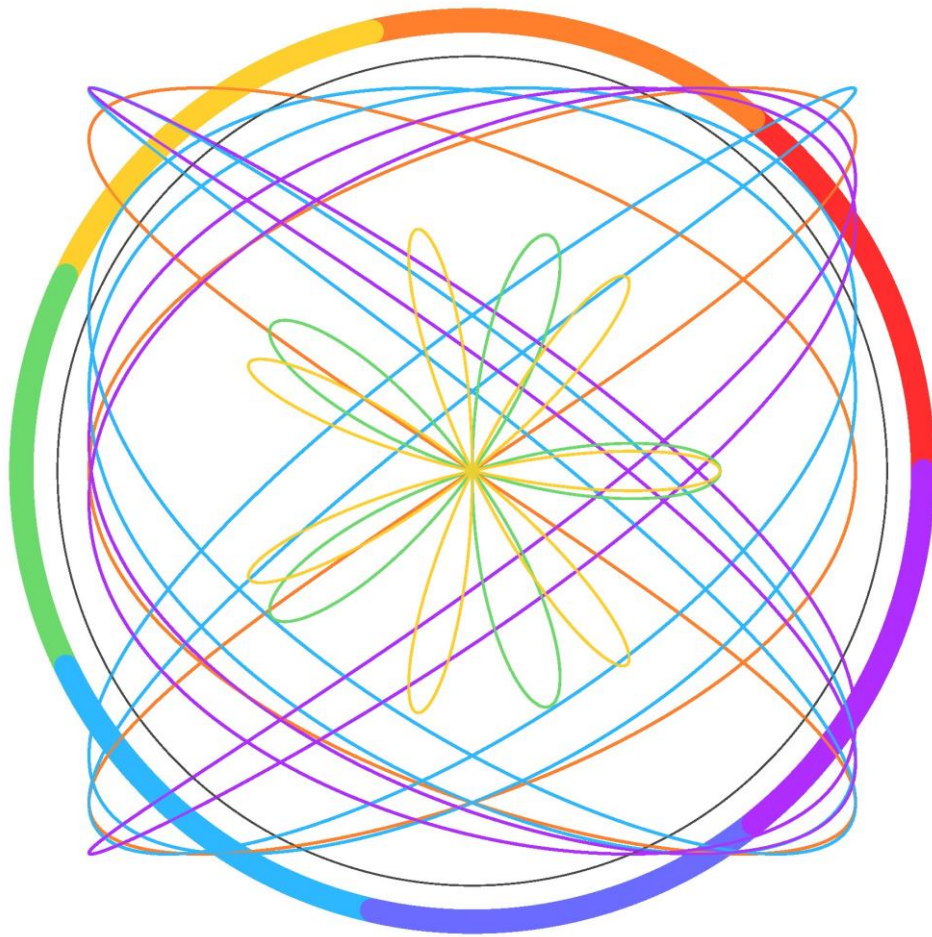


Fig. 1

Description of the Diagram: “The Position of the Karmil Stream System in the Structure of Knowledge”

The graphical model (see Fig. 1) reflects the conceptual position of the **Karmil Stream System (KSS)** within the historical and interdisciplinary continuum of scientific discovery.

The diagram is designed as a **multicolored circle**, symbolizing the closed and continuous evolution of human knowledge as well as the equal value of all domains of inquiry.

1. Outer Ring Spectrum (Principal Disciplinary Axes)

The outer circumference is divided into **seven color segments**, corresponding to the fundamental domains of human knowledge.

The colors are arranged according to **spectral continuity**—from red to violet—visualizing the **energetic gradient of cognition**:

- **Red** (#FF2D2D) – *Physics of motion* (dynamics, energy, laws of conservation)
- **Orange** (#FF7F2D) – *Mathematics and topology* (formal structures, symmetries, fields)
- **Yellow** (#FFCF2D) – *Music and acoustics* (sound, vibration, frequency nature)
- **Green** (#6BD96B) – *Biology and cognitive sciences* (perception, rhythm organization)
- **Light Blue** (#2DB7FF) – *Informatics and computational methods* (algorithms, codifiability)
- **Blue** (#6B6BFF) – *Philosophy and systems theory* (ontology of motion, dualism)
- **Violet** (#B02DFF) – *Aesthetics and art* (expression of form, semantic energy)

These sectors form a **unified spectrum of interaction**, where each color represents not an isolated discipline but a **vector of transformation**—a direction along which knowledge streams and evolves.

This construction embodies the **principle of streamness**, the central idea of the Karmil Stream System, according to which everything that exists is in a state of motion and transition.

2. Inner Curves (Interaction of Streams)

At the center of the circle lies a network of **Lissajous and rosette curves**, rendered in the same spectral palette but with reduced opacity (≈ 0.8).

These curves represent the **ascending (AS)** and **descending (DS)** streams of musical energy in terms of **phase dynamics**.

Their intersections form **patterns of energetic resonance**, analogous to coherent states in physics.

1. **Orange and blue** curves symbolize the phase duality of AS and DS — upward motion (accumulation of energy) and downward motion (release or relaxation).
2. **Green and yellow** trajectories denote **resonant field states**, moments of coherence ($\psi \approx 1$).
3. **Violet and blue** lines illustrate **uniphase transitions**, where opposing directions merge into continuous motion.

The inner region thus visualizes **Uniphase** — the central principle of KSS, where phase and antiphase are treated as two segments of a single continuous cycle.

3. Central Area (Uniphase Point)

At the diagram’s core, all trajectories intersect, forming a **white coherence zone** symbolizing the **uniphase state** ($\Phi = 0, \psi = 1$).

This is the **topological center** of the Karmil Stream System — the point where ascending and descending streams are balanced, and energy closes into a **stable cyclic motion**.

In physical terms, it represents a **zero-potential state of the field**; in aesthetic terms, it is a **moment of harmony between form and meaning**.

4. Meaning of the Diagram

The diagram demonstrates that the **Karmil Stream System** does not stand above or outside other disciplines; it exists at their **intersection**, as an integrating contour linking the natural sciences and the humanities.

KSS unites what was traditionally separated: *motion* as a physical phenomenon and *form* as an artistic process. Its position lies within the **core of the spectrum**, where the lines of **physics, music, and topology converge**.

5. Interpretation of the Discovery’s Position

If the working hypothesis of the KSS is confirmed through external academic verification, the system will occupy a **cross-disciplinary position** comparable in significance to the *theory of relativity* in physics or *Pythagorean numerical harmony* in music.

The circle does not represent a hierarchy of knowledge; it illustrates a **new dimension of cognition** — a shift from *describing form* to *describing stream*, from *structure* to *motion*, from *observation* to *modeling*.

Thus, the diagram visually affirms the central achievement of the Karmil Stream System: the **transition of music**

from the category of *art* to the category of a **modelable physical process**, while preserving its **expressive and semantic depth**.

Conclusion

The **Karmil Stream System (KSS)** was born from the desire to view music not as a sequence of sounds but as a **living field of directed motion** — interrelated, energetically balanced, and governed by internal laws. In recent months, the system has evolved from a conceptual model into a **formalized, computationally verifiable framework**: musical processes can now be **encoded, modeled, and empirically tested**, just like physical phenomena.

Its central breakthrough is the identification of **streamness** as a **fundamental property of music** — its ability to exist as *motion* rather than as a *collection of elements*.

Traditional theories have focused primarily on **ascending processes** (growth and climax), leaving **descending motion** at the margins of analysis.

By introducing the **descending stream (DS)** with its own tonal organization, the **symmetry of musical energy** has been restored.

The **duality of streams** — ascending (AS) and descending (DS) — naturally leads to the concept of **Uniphase**, which shows that opposites do not conflict but form a **single continuous stream**.

This unity forms the foundation of **music as a physical field**.

Today, the **Karmil Stream System** stands at the **border of art and science**. It can be analyzed, modeled, and programmed — translated into **computational formats**. This opens the way toward a **new type of musical analysis** — *energetic-phase analysis*, bridging **aesthetics, physics, and mathematics**.

The work is currently undergoing **academic verification**.

The final word belongs to the reviewers, whose evaluation will determine whether the theory gains official recognition.

But even beyond institutional boundaries, its essence has already been proven in practice:

a stream, once discovered, does not vanish — it continues to stream toward those who are ready to hear it.

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