

## Reframing the Concept of Gravity in Teacher Education: Bridging Vedic and Classical Sanskrit Insights with Newtonian and Quantum Theories

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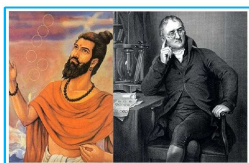
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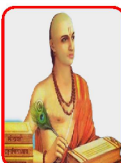
### INTRODUCTION & AIM

Re-examining fundamental scientific ideas through indigenous intellectual traditions provides significant scope for innovation in teacher education. This paper critically explores the conceptualization of gravitational force in the Sanskrit literature, tracing its development from Vedic cosmology in the Rigveda to systematic astronomical discussions in the Siddhanta Shiromani by Bhāskara II [1]. The notion of gurutva (attractive force) described in these sources presents a qualitative understanding of gravitational attraction, which may be pedagogically aligned with later scientific formulations. Investigate the conceptual parallels between Sanskrit notions of *gurutva* and modern gravitational theories, and to assess their pedagogical relevance in enhancing science teacher education

Ancient Indian Muni Kanada (c. 600–200 BCE), in the Vaisheshika Sutra[2], proposed the Paramanu—indivisible matter. About 2,300 years later, English scientist John Dalton (1766–1844) formulated modern atomic theory in *A New System of Chemical Philosophy* (1808)[3].

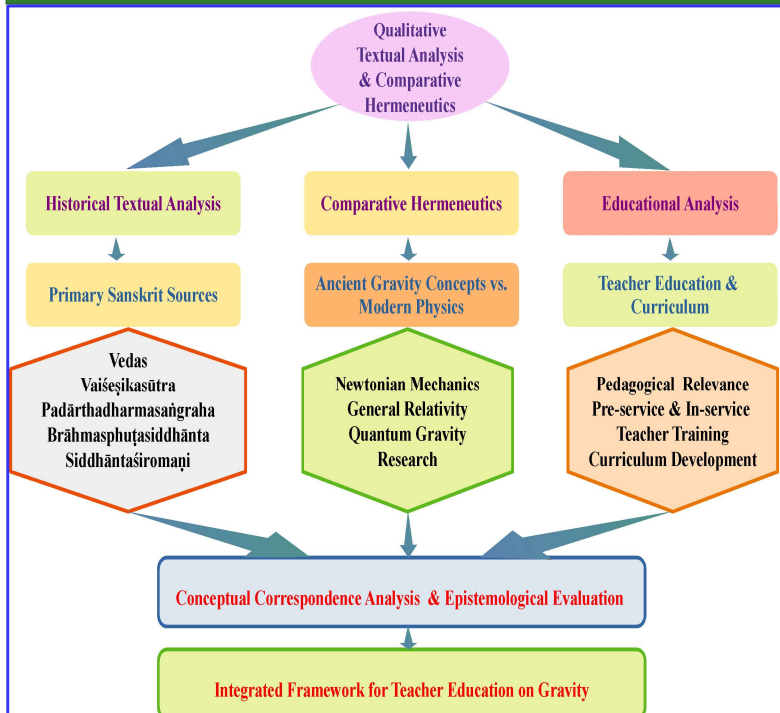


**Bhāskara II [1]**  
explicit premodern discussions of attraction:  
"आकर्षणशक्तिर्गृहीतव्या यस्त्वानिमुखं स्वयत्का ।  
आकर्ष्यते तस्यतवीव भाति समन्तात् क पतत्ये वे ॥"  
"The Earth possesses an attractive power.  
By that power it draws objects toward itself.  
Therefore objects appear to fall toward the Earth. In space, where would anything fall?"



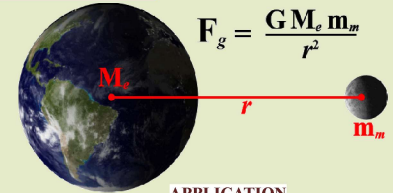
| Framework       | Time Period  | Central Concept  | Nature of Gravity       | Description  |
|-----------------|--------------|------------------|-------------------------|--|
| Vedic           | 1500–500 BCE | Rta              | Cosmic Order            | Early Vedic literature such as the Rigveda and later Vedic texts contain cosmological ideas concerning Earth, sky, and cosmic order (rta). |
| Vaiśeṣika       | 600–200 BCE  | Gurutva          | Natural Tendency        | Founded by Kanada. Discussed concepts such as gurutva (heaviness), motion, and atomism in the Vaiśeṣika Sūtra [4]                          |
| Bhāskara-II     | 1114–1185 CE | Ākarsana-śakti   | Earth's Attraction      | Indian mathematician-astronomer who referred to Earth's attractive power (ākṛṣṭi-śakti) in the Siddhānta Siromani [1]                      |
| Newton          | 1642–1727 CE | Universal Force  | Mathematical Attraction | Formulated the Law of Universal Gravitation and classical mechanics (1687). [2]  |
| Einstein        | 1879–1955 CE | Curved Spacetime | Geometric Phenomenon    | Developed General Theory of Relativity, describing gravity as spacetime curvature. [5]   |
| Quantum Gravity | From 1930 CE | Quantum Geometry | Emergent Interaction    | Ongoing field seeking to unify quantum mechanics and gravity. Includes approaches such as Loop Quantum Gravity and String Theory [6].      |

### METHOD



### RESULTS & DISCUSSION

#### CONCEPT OF GRAVITATION



The Twenty-Four Gunas in Vaiśeṣika Philosophy [4] parallel modern science through properties of matter, motion, perception, cognition, and causality.

|                                      |                                  |                            |                         |
|--------------------------------------|----------------------------------|----------------------------|-------------------------|
| 1 Rupa (Colour)                      | 2 Rasa (Taste)                   | 3 Gandha (Smell)           | 4 Sparśa (Touch)        |
| 5 Saṅkhyā (Number)                   | 6 Parimāṇa (Magnitude)           | 7 Pṛthaktva (Distinctness) | 8 Samyoga (Conjunction) |
| 9 Vibhāga (Disjunction)              | 10 Paratva (Remoteness)          | 11 Aparatva (Nearness)     | 12 Buddhi (Cognition)   |
| 13 Sukha (Pleasure)                  | 14 Duḥkha (Pain)                 | 15 Iecā (Deceit)           | 16 Dveṣa (Aversion)     |
| 17 Prayatna (Effort)                 | 18 Gurutva (Gravity / Heaviness) | 19 Dravarva (Fluidity)     | 20 Sneha (Viscosity)    |
| 21 Samskāra (Dispositional tendency) | 22 Dharma (Merit)                | 23 Adharma (Demerit)       | 24 Śabda (Sound)        |

**Colour (Rūpa) as a Guṇa**  
In Vaiśeṣika philosophy, Rūpa (colour) is one guṇa that inheres in a substance (dravya) and cannot exist independently. A guṇa always resides in a substance through Samavāya (inherence) and disappears when its Substratum is destroyed. The nature of guṇa is expressed as: द्रव्याश्रयगुणवान् संयोगविभागेऽकारणमनपेक्ष इति गुणलक्षणम् ।  
"A guṇa resides in a substance, does not possess further qualities, and is not an independent cause of conjunction or disjunction."  
Colour is defined by Kanada as: रूपं चक्षुरग्रहणम् । rūpam cakṣurgrāhya-guṇah "Colour is the quality apprehended by the eye." According to Vaiśeṣika, colour is an objective and real property inhering mainly in earth (pṛthivī), water (ap), and fire (tejas). Colour cannot be perceived apart from the object in which it resides. Thus, the brown colour of a clay pot and the whiteness of a white cow exist inseparably in those substances.

**Gurutva as a Guṇa in Vaiśeṣika Philosophy**  
Gurutva (gravity or heaviness) is a guṇa (quality) in Vaiśeṣika philosophy that causes objects to move downward. The term derives from guru, meaning "heavy."  
• Vaiśeṣika defines it as- "गुरुत्वं पतनकारणम् ।" "Gurutva is the cause of falling."  
According to the Vaiśeṣika system:  
• Heavy objects possess gurutva.  
• When support is removed, gurutva initiates downward motion.  
• The continuation of motion is explained by veṅa (momentum-like force) and samskāra (residual tendency).  
• The Vaiśeṣika Sūtra states: "संयोगभावे गुरुत्वात् पतनम् ।" "When supporting conjunction is absent, falling occurs because of gurutva."  
Later, Annambhatta in the Tarkasamgraha [7] described: "गुरुत्वं पतनस्यासाधारणकारणम् ।" "Gurutva is the special cause of falling."  
He further explained that gurutva exists mainly in earth and water and is responsible for initiating motion, while veṅa and samskāra account for its continuation. Thus, Vaiśeṣika presents an early naturalistic explanation of gravity by distinguishing between the cause of the beginning of motion and the cause of its continuation. This idea was proposed by Galileo Galilei (1592–1610) in modern science.

### CONCLUSION

- Sanskrit perspectives on gravity enrich teacher education by linking modern physics to global intellectual history.
- Integrating Vedic and classical ideas broadens understanding of scientific development.
- Bridging traditional thought with Newtonian mechanics deepens conceptual clarity.
- Connecting these views with quantum gravity encourages reflective and inclusive pedagogy.
- Overall, this integration supports a more holistic and conceptually unified approach to science education.

### FUTURE WORK / REFERENCES

Future work should extend comparative studies of Indian knowledge systems with other non-Western traditions to develop a global history of physics. Post-literature survey, empirical research may assess the impact of Sanskrit cosmological ideas on understanding gravity in teacher education. Developing pedagogical modules and digital tools linking Vedic, Newtonian, relativistic, and quantum frameworks is also recommended.

- [1] Bhāskara II (12th century). Siddhāntaśiromāni.
- [2] Newton, I. (1687) Philosophiæ Naturalis Principia Mathematica.
- [3] Dalton, J. (1808). *A new system of chemical philosophy* (Vol. 1). R. Bickerstaff.
- [4] Kanada. (1911). *The Vaiśeṣika Sūtras of Kanada: With the commentary of Saṅkara Miśra* (N. L. Sinha, Trans.). Allahabad: The Panini Office, Bhubaneswari Ashrama.
- [5] Einstein, A. (1916). *The foundation of the general theory of relativity*. Annalen der Physik, 49, 769–822. <https://doi.org/10.1002/andp.19163540702>
- [6] Rovelli, C. (2004). *Quantum gravity*. Cambridge, UK: Cambridge University Press.
- [7] Annambhatta. (2010). *Tarkasamgraha with Dipika Commentary*. Varanasi: Chowkhamba Sanskrit Series Office.