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# Time measurement in Indian tradition and the present-day representation of time as a continuum

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## Abstract

The “laws” of physics are today formulated using ordinary or partial differential equations. On the current mathematical understanding of the calculus, the use of derivatives with respect to time makes sense only if time corresponds to real numbers, or the continuum.<sup>1</sup>

This talk will explore the curious historical origins of this belief, in the Indian tradition of time measurement, which led to the development of infinite series and the calculus in India.<sup>2</sup> This was subsequently transmitted to Europe by Jesuits in the 16th c. CE in connection with the European navigational problem—but the Indian procedures could not be grasped by European mathematicians, on account of certain religiously conditioned metaphysical beliefs regarding the nature of mathematics.<sup>3</sup> Hence, as in the case of the algorismus earlier, the calculus too took several centuries to be assimilated in Europe—this required the formalisation of real numbers, by Dedekind cuts, and the formalisation of the set theory needed for that. Thus, a cultural misunderstanding has forced time to be a continuum—not at all required on other considerations.

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<sup>1</sup>C. K. Raju, *Time: Towards a Consistent Theory*, Fundamental Theories of Physics, vol. 65, Kluwer Academic, Dordrecht, 1994.

<sup>2</sup>C. K. Raju, *Cultural Foundations of Mathematics*, Project of History of Indian Science, Philosophy and Culture vol. X(4), New Delhi, 2005 (to appear).

<sup>3</sup>C. K. Raju, “Computers, Mathematics Education, and the Alternative Epistemology of the Calculus in the *Yuktibhāṣā*”, *Philosophy East and West* **51**(3) (2001) 325–62