

## Seminar SAW Seminar History and Philosophy of Mathematics – 2011-2016

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### Mathematics, Astral science and Trigonometry

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*Determining the declination: Some reflections on trigonometry in the Sanskrit astral sciences*

**Abstract** – Solar declination is a very important concept in astronomy and relies heavily on trigonometry. The twelfth century Indian scholar, Āmarāja, gives us insight into the various nuances surrounding its role and reckoning in his commentary to the Khaṇḍakhādyaka by noted seventh century CE Indian astronomer Brahmagupta. Āmarāja devotes a large part of his commentary to providing the background computations and underlying mathematical techniques to declinations presented in this work. In order to understand how these numbers had been generated, we examined the four rules that Āmarāja gives for determining the sine and the arc, two which are based on linear interpolation, and two which are based on non-linear interpolation. We were guided by the following questions as we looked at the numerical data Brahmagupta presented: where is trigonometry found in the astral sciences, both explicitly and implicitly, what accounts for the alternative operations to compute the arc and the sine, in what contexts are they invoked, how can numerical data give insight into the mathematical operations that the actors were using, what are the nuances behind the technical terminology. While investigating Āmarāja's numerical derivations of Brahmagupta's values we were sensitive as to whether or not Āmarāja had used linear or second order interpolation, using the precision of the given numerical data to detect which procedure had been adopted. This led us to question whether or not there was a uniform approach to approximation. We noted as we explored the commentary of Āmarāja on this passage that certain sines seem to have been more important than others and required a more precise value. Furthermore we reflected on the significance of such procedures being a device which was not a part of gaṇita. Further study will consider interpolation more broadly as a form of interpolation, and consider the other forms of approximation that exist in this work.