Math Grad Student Formulates Tetraheda Packing Breakthrough

U-M Mathematics graduate student Elizabeth Chen found a method of densely packing regular tetrahedra, one of the five Platonic solids, in space. In her 2008 article in the journal Discrete & Computational Geometry [1], Chen used a computer algebra system to optimize placement of the regular tetrahedra—solid figures with four triangular faces—in a "wagon wheel" type formation, and achieved a packing density of 77.86%. This was a vast improvement over the previous record of 71.75%. This research showed that tetrahedra can be packed more densely than spheres. Understanding the efficient packing of solids is key in the development of error-detecting and error-correcting codes used in the storage and compression of information for electronic transmission, as well as material science and engineering. A variant of Chen's "ingenious construction" [2] has been developed by materials scientists S. Torquato and Y. Jiao from Princeton in their research [3] to achieve more densely packed tetrahedra (78.2%) in a lattice formation. The latter research is featured on the cover of the August 13, 2009 issue of Nature, and on the website of the American Mathematical Society.

[1] Chen, Elizabeth, *A dense packing of regular tetrahedral*, Discrete Comput. Geom. 40 (2008), 214–240. http://www.springerlink.com/content/f06j66h83424q440/fulltext.pdf

[2] Cohn, Henry, *A tight squeeze*, Nature 460 (13 August 2009), 801–802. http://www.nature.com/nature/journal/v460/n7257/full/460801a.html

[3] Torquato, Salvatore and Jiao, Yang, *Dense packings of the Platonic and Archimedian solids*, Nature 460 (13 August, 2009), 876–879. http://www.nature.com/nature/journal/v460/n7257/full/nature08239.html