1067-52-2232 **Abhinav Kumar*** (abhinav@math.mit.edu), MIT Department of Math, Rm 2-169, 77 Massachusetts Avenue, Cambridge, MA 02139, and **Henry L Cohn** (cohn@microsoft.com) and **Achill Schuermann** (achill.schuermann@uni-rostock.de). *Lattices, periodic configurations and Gaussian potential energy.*

The potential energy of a lattice for the Gaussian potential $\exp(-2\pi c r^2)$ is essentially the value of its theta function $\theta(z)$ at $z = \sqrt{-1}c$. Similarly, the Gaussian potential energy for a periodic configuration is related to a value of its average theta function. Minimizing this function over the space of lattices or periodic configurations is a natural problem in physics, but also relevant to geometry (for instance, the limit as $c \to \infty$ is essentially the sphere packing problem). I will describe joint work with Henry Cohn and Achill Schürmann which performs computer simulations of gradient descent on spaces of periodic configurations with a small number of translates in low dimensions. This leads to counterexamples to conjectures of Torquato and Stillinger that the minima for energy are the densest lattices or their duals. We also find some other interesting phenomena such as the existence of formally dual periodic structures, which satisfy the analogue of Poisson summation for lattices. (Received September 22, 2010)