February 8 and 15: David Vogan (MIT), *Software for unitary representations.*

Let G be a linear real reductive Lie group. By the 1980s it was understood that computing the unitary dual of G amounted to answering the question

is π unitary?

for a finite set of irreducible representations π of G. For a fixed π, it was also understood that answering this question amounted to deciding the positivity of a finite collection of symmetric matrices with rational entries; so the answer was in principle computable. But the size of the matrices involved (for $Sp(8, C)$, the largest has size 38,625) made the calculation impractical except for a few very small groups.

Work with Jeffrey Adams, Marc van Leeuwen, and Peter Trapa, and other work with George Lusztig, provided an algorithm based on the Kazhdan-Lusztig algorithm for answering this question. This algorithm has now been implemented in the `atlas` software: one can enter any G and π, ask whether π is unitary, and receive an answer. In the first talk I'll demonstrate the software, and talk about the main ideas behind it. In the second talk, I'll discuss some of the details: why five years elapsed between the mathematical formulation of the algorithm and the completion of the software.