

## REU Summer 2008, Geometric Tomography - Donald C. Solmon

The area of geometric tomography, (see Gardner's book "Geometric Tomography"), provides a wealth of problems accessible to students with a knowledge of undergraduate linear algebra and advanced calculus, and solvable by those with ingenuity and perseverance.

The subject originates with a vaguely worded question by P. C. Hammer:

*How many X-rays are needed to determine the location and shape of a convex hole inside of a homogeneous body?*

(A set  $K$  is convex if given any two points in  $K$  the line segment joining the two points also lies in  $K$ .) A convex body is a compact, convex set with nonempty interior.

The projects deal with X-rays and convex bodies in the plane, although the questions may be posed in three dimensional space or more generally  $R^n$ . For us, the data provided by an X-ray are (usually) the chord lengths of the intersection of a convex body with all rays emanating from a point source, so called directed X-rays. Difficult problems remain involving uniqueness, and more accessible problems are available on reconstruction and stability of reconstruction algorithms. There are also problems on consistency of data (given two or more functions, when are they X-rays of some convex body).

While most of the work of previous REU projects has involved planar convex bodies, many of the problems posed (and solved) there remain open in three or more dimensions.