

## Project 2: Medical imaging of potatoes

Math 647, Spring 2009

*Due Monday, 3/30*

Laser light is often used in medical imaging, to aid in non-invasively identifying the status or classifying human tissue. This next project will investigate the mathematics of light diffusion through a turbid medium. Since human experimentation raises obvious problems, we will look at the ethically simpler case of potatoes. I have posted on our web site pictures of slabs of potatoes with various intrusions (coins, actually), illuminated by a flashlight, which you will take as data. I also have posted some m-files which you might find useful. One of them shows how you can read a jpeg into Matlab as data, which you will find invaluable. In addition, I have posted references, including several books which I have put on reserve at Evans library.

Your report should outline a model which will answer the following questions:

1. A thicknesses of 1 cm, 1.5 cm, and 2 cm, what is the smallest radius disk (placed on the mid-plane of the slab, although not at the center of the disk) which is reasonable to expect to detect with this apparatus?
2. I will give you a challenge of predicting an image for a certain situation based on your model (I'll describe this in detail later). I will then compare your prediction with the actual image.

There are basically two approaches one can take to this problem: either simulate a large number of photons propagating through the tissue (called the Monte Carlo model of light transport), or to solve a PDE coming from the diffusion approximation to Radiative Transfer Equation. I'm going to want you to use the Monte Carlo model: I think that it's easier to understand and to program, although it may take a fair amount of computation time.