One role of a medical physicist is to help maximize patient benefit while minimizing the cost of a diagnostic procedure. In many instances, this can be restated as maximizing image quality while minimizing risk to the patient. This is a complex task, but a number of concepts have been developed over the years that are useful in quantifying image quality, namely, modulation transfer function (MTF), noise (Wiener) power spectrum (NPS), noise equivalent quanta (NEQ), and detective quantum efficiency (DQE). These concepts are measured in the spatial frequency domain. The MTF describes the spatial resolution properties of the system, the NPS describes the noise properties, and together they can be combined to determine the NEQ, which is related to the signal-to-noise ratio (SNR) of the system. The DQE describes how efficiently information (SNR) is passed through the system. Drawing on examples from x-ray imaging, I will describe what these concepts are, how they are measured and how they can be used.

Educational Objectives

1. Understand the concepts of modulation transfer function (MTF), noise (Wiener) power spectrum (NPS), noise equivalent quanta (NEQ), and detective quantum efficiency (DQE).
2. Understand how measure MTF, NPS, NEQ, and DQE for analog detectors
3. Understand how measure MTF, NPS, NEQ, and DQE for digital detectors