# Chapter 1 : Introduction

## 1.1 : Quasi-Stellar Objects

The nuclei of a fraction of galaxies emit non-stellar radiation with a luminosity which may be much larger than the sum of the light from all the stars making up the galaxy. Unlike ordinary stars, this source emits significant fractions of its light over a wide wavelength range from radio waves to gamma rays, from a volume many orders of magnitude smaller than the galaxy itself. This relatively compact source of radiation is called an active galactic nucleus (AGN).

Quasi-stellar objects (QSOs) are believed to be AGNs at much greater distances. They appear as point (stellar-like) sources because the angular size of the host galaxy and its surface brightness has been reduced by distance to where the nuclear source smeared by atmospheric seeing dominates the image. The defining characteristics of a QSO (or AGN) include the presence of emission lines superimposed on a smooth continuum. This continuum source probably originates from a combination of several thermal and non-thermal sources and is continuous over most of the electromagnetic spectrum. The emission lines come from ionized gas clouds in the immediate environment of the central continuum source.

The distinction between QSOs and (non-QSO) active galaxies is somewhat arbitrary, but usually to be considered a QSO an object must appear stellar-like on the Palomar Sky Survey and exhibit broad emission-lines which imply an emission-line redshift ($z_e$) of at $\gtrsim$0.1 (z=1−[observed wavelength/rest wavelength]). QSO redshifts are thought to be due primarily to the expansion of the universe, and thus we can derive intrinsic luminosity, distance, and the light-travel time from the object using the standard model for the expansion of the universe including the the expansion velocity parameter or Hubble constant, $H_o$, and the deceleration parameter, $q_o$.