HUBBLE SPACE TELESCOPE IMAGES OF A SAMPLE OF TWENTY NEARBY LUMINOUS QUASARS [a]

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Observations with the Wide-Field Camera of the *Hubble Space Telescope (HST)* are presented for a representative sample of 20 intrinsically luminous quasars with redshifts smaller than 0.30. These observations show that luminous quasars occur in diverse environments that include ellipticals as bright as the brightest cluster galaxies (2), apparently normal ellipticals (10), apparently normal spirals with H II regions (3), complex systems of gravitationally interacting components (3), and faint surrounding nebulosity (2). The quasar host galaxies are centered on the quasar to the accuracy of our measurements, 0.3 kpc. There are more radio quiet quasars in galaxies that appear to be ellipticals (7) than in spiral hosts (3), contrary to expectations. However, three, and possibly five, of the six radio loud quasars have detectable elliptical hosts, in agreement with expectations. The 20 objects studied in this paper show that luminous quasars occur preferentially in luminous galaxies. The median observed luminosity of the hosts is 0.4 magnitudes brighter than L*, a result that is inconsistent with the field galaxy luminosity function. The superb optical characteristics of the repaired *HST* make possible the detection of close galactic companions; we detect eight companion galaxies within projected distances of 10 kpc from quasar nuclei. The presence of very close companions, the images of current gravitational interactions, and the higher density of galaxies around the quasars suggest that gravitational interactions play an important role in triggering the quasar phenomenon.

1 Introduction to the Pictures

You may well wonder what a talk on luminous, small redshift quasars is doing in a conference devoted to HST and the high-z universe. The ostensible reasons for including this talk are: 1) the observations at small redshift are the basis for determining what evolution has occurred at the larger redshifts; and 2) the greater detail that is available in the images of small redshift quasars may be useful in interpreting the observations of larger redshift objects.

In fact, the real reason for including this talk was that the presenter(JNB) wanted to express in person his admiration and affection for Alec Boksenberg as

[a]Based on observations with the NASA/ESA Hubble Space Telescope, obtained at the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555.

a creative scientist, an original instrument builder, an inspirational organizer, and a wonderful friend.

The talked summarized the results of our analysis of *HST*-WFPC2 observations of a representative sample of 20 of the most luminous ($M_V < -22.9$) nearby ($z < 0.30$) quasars. The goal of these observations was to help understand the quasar phenomenon by determining the environment in which quasars occur. The main result of this paper is that there is not one type of environment, but instead a wide range of environments in which the most luminous quasars appear to be embedded. The *HST* images also contain a number of extraordinary phenomena and some surprises, including: very close companions, host ellipticals for radio quiet quasars, spiral hosts with well developed arms and prominent H II regions, galaxies caught in the act of merging, apparently faint galactic hosts, and very extended emission.

The results of this work have been published partially in a series of papers in ApJ and ApJ Letters and, more recently, in a summary paper, with the same title as this talk, that has been submitted to ApJ and is available (with references to earlier work by ourselves and by many other researchers) at http://www.sns.ias.edu/~jnb (see Some Recent Preprints and Reprints).

Figure I shows the unprocessed images (without subtraction of the stellar quasar) for all 20 of our program objects. It is apparent from these images that luminous quasars have a variety of environments. More details are available in the complete paper on the subject described above.

Acknowledgments

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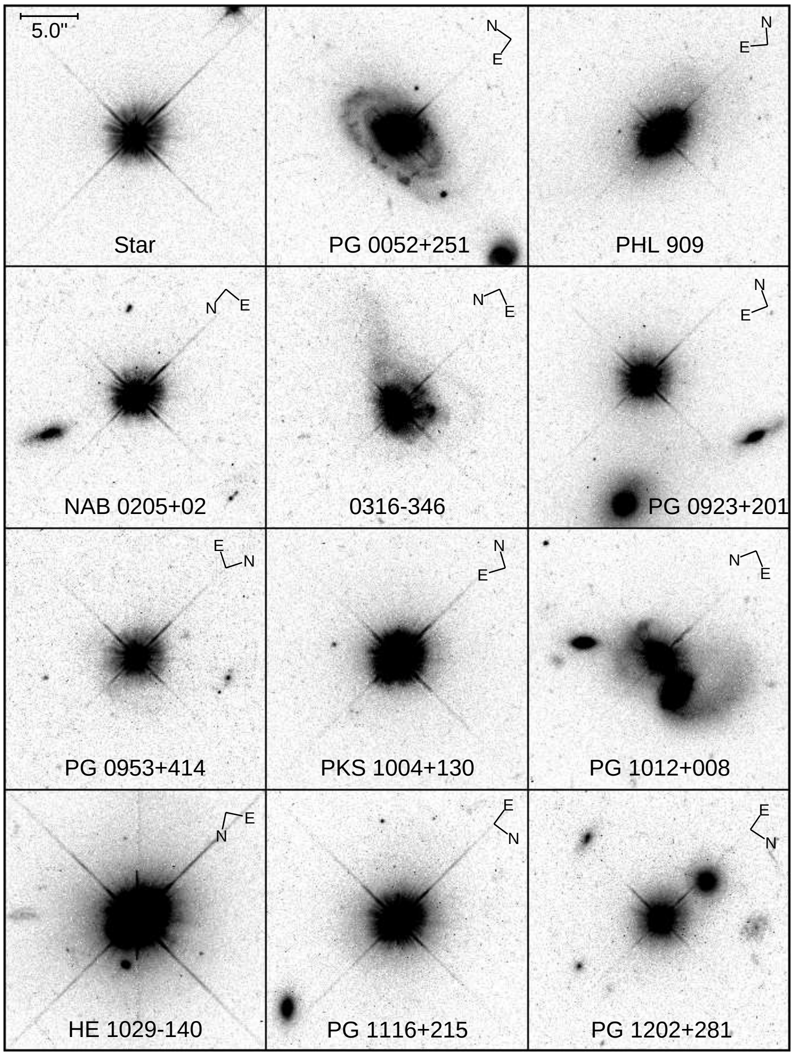

Figure 1: A $23'' \times 23''$ WF image of each one of the twenty luminous nearby quasars in our sample. A blue field star, MMJ 6490, is also shown for comparison (first panel). These images were obtained using the *HST* WF3 and the F606W filter. The exposure times are 1400 s or 1100 sec. Cosmic ray subtraction and pipeline STScI flatfielding are the only processing performed on the *HST* images shown here.

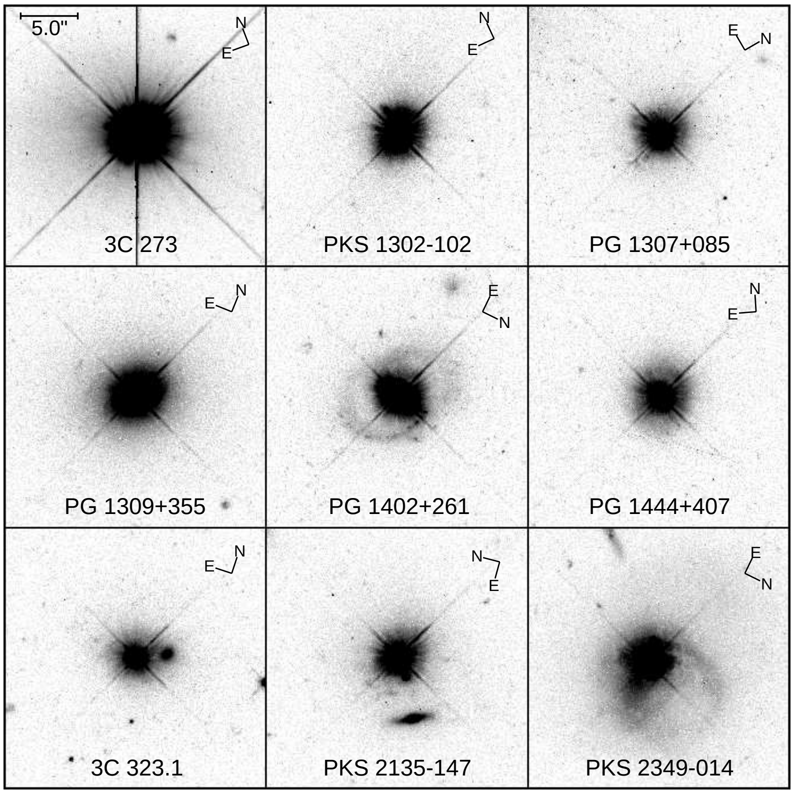

Figure 1: *Continued*