STATISTICAL ANALYSIS OF OPTICALLY VARIABLE QSOs AND BRIGHT GALAXIES: A HINT FOR GRAVITATIONAL LENSES?

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Nieto (1979) found an excess of optically variable QSOs (OV) near bright galaxies ($m < 15.7$): 6 observed versus 1.6 expected for $r < 5'$. The probability involved was $p = 5 \times 10^{-3}$. Because of the small number of OV QSOs in this sample ($N = 41$, sample 1), this result needed a confirmation. So the same analysis was repeated with a sample of 112 QSOs (sample 3) from Hewitt and Burbidge (1980). Eleven objects were observed at $r < 5'$ versus 4.4 expected, so $p = 4 \times 10^{-3}$, the sample made up with 71 objects (sample 2) supporting slightly the result found with the first 41 objects. A notable difference between these two samples 1 and 2 is that the objects included in sample 2 are fainter than the objects included in sample 1. Repeating then the same analysis on samples of QSOs at different brightness levels suggests that the excess is related to the apparent brightness of the QSOs.

Concerning the output of statistical studies of QSO-galaxy associations, our results can be summarized in the following fashion:
-- the strong excess presented at first by the brightest radio QSOs is not confirmed by much larger QSO samples (see Nieto, 1978);
-- the same analysis repeated for various classes does not yield particular feature of the QSO distribution with respect to galaxies (Nieto 1978, 1979), except for: 1) bright and 2) optically variable QSOs, as shown by our sample 3 confirming the preliminary study made with sample 1.

We are tempted to believe that these statistical results can have a physical explanation which need not call into question a cosmological nature of QSOs. They could perfectly fit in the following scenario independently suggested by Canizares (1981), namely gravitational lens effects by stars located in the halos of intervening galaxies.

Then, a random distribution of QSOs with respect to galaxies would appear unrandom to us if some QSOs being (by chance) on the line of sight of a galactic halo (and their cosmological distances) are submitted to a gravitational lens effect coming from a halo star. Such a phenomenon would affect the luminosity function of QSOs in the neighborhood of galaxies and would produce some variabilities in the lensed images of the QSOs (already variable or not).

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REFERENCES

Canizares, C.R. 1981, Nature, 291, 620.
Hewitt, A.H., Burbidge, G.R. 1980, Ap. J. Suppl., 43, 57.
Nieto, J.-L. 1978, Astron. Astrophys., 70, 219.
Nieto, J.-L. 1979, Astron. Astrophys., 74, 152.

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