Power Law Decays in the Optical Counterparts of GRB 970228 and GRB 970508

M. R. Garcia[1], P. J. Callanan[2] D. Moraru[1], J. E. McClintock[1], E. Tollestrup[1], S. P. Willner[1], C. Hergenrother[3], C. R. Robinson[4], C. Kouveliotou[4], and J. van Paradijs[5,6]

ABSTRACT

We report on R_c and K band observations of the optical counterpart to GRB 970508 with the Fred Lawrence Whipple Observatory (FLWO) 1.2m telescope. Eleven R_c-band observations were obtained on 1997 May 12, and three on May 14. The counterpart clearly faded between the two nights. On May 12 there was no evidence for variability ($< 9\%$) on 10-70 minute time scales based on 11 R_c-band observations. On May 19 a one hour observation set a limit on the K magnitude of K >18.2. Comparison of these data points with those obtained by other authors shows that the decay of the optical counterpart can be well fitted by a power law of the form $f \sim t^{-\alpha}$ where $\alpha = 1.22 \pm 0.03$ with occasional fluctuations superposed. We note that the decay of the optical counterpart to another burst, GRB 970228, can also be well fitted with a power law with exponent $\alpha = 1.0^{+0.2}_{-0.5}$ with occasional fluctuations superposed. These two decay light curves are remarkably similar in form to that predicted by cosmic-fireball models.

Subject headings: gamma rays: bursts

[1]Center for Astrophysics, 60 Garden St., Cambridge, MA 02138; mgarcia, dmoraru, jmcclintock,etollestrup,swillner, @cfa.harvard.edu

[2]Physics Department, University College, Cork, Ireland; paulc@ucc.ie

[3]Lunar and Planetary Lab, University of Arizona, Tucson, AZ; chergen@pirl.lpl.arizona.edu

[4] Universities Space Research Association and Marshall Space Flight Center, ES-62, Huntsville, AL 35812; craig.robinson@msfc.nasa.gov, kouveliotou@eagles.msfc.nasa.gov

[5]University of Amsterdam, Physics Department, 403 Kruislaan, 1098SJ Amsterdam, Netherlands; jvp@astro.uva.nl

[6]Department of Physics, University of Alabama in Huntsville, AL 35899