Evidence for Rapid Photodestruction of Interstellar Dust by Radiation from Gamma-Ray Burst 120119A

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We present a time-resolved analysis of the dust properties along the line of sight to gamma-ray burst (GRB) 120119A at redshift z = 1.73. Late-time photometric observations of the burst's optical afterglow show evidence for a moderate column of dust (A_V ~ 1.1 mag) with an extinction curve similar to, but statistically distinct from, dust seen along Small Magellanic Cloud sightlines. However, our earliest observations exhibit a significant red-to-blue color change in the first ~200 s after the burst at levels heretofore unseen in GRB afterglows. This color change, which is coincident with the final phases of the prompt emission, is a hallmark prediction of the photodestruction of dust in GRB afterglows. We test whether dust-destruction signatures are significantly distinct from other sources of color change, namely a change in the intrinsic spectral properties of the GRB itself. We find that a time-varying spectrum within the constraints of accepted GRB models cannot alone adequately describe the observed color change, and allowing for dust destruction (via a time-varying A_V) significantly improves the fit. While not definitively ruling out other possibilities, this event provides the best support yet for the direct detection of dust destruction in the local environment of a GRB.