

Did Dark Matter Kill the Dinosaurs?

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Recent studies of the effects on the Earth's atmosphere by astrophysical sources, such as nearby gamma-ray bursts or supernovae, have shown that these events could lead to severe changes in atmospheric composition. Depletion of ozone, the most notable of these changes, is extremely dangerous to living organisms as any decrease in ozone levels leads to an increase in the irradiance of harmful solar radiation at the Earth's surface. In this work we consider dark matter as an astrophysical source of gamma rays, by the annihilation and decay of WIMPs found within dark compact halo objects known as UltraCompact MiniHalos (UCMHs). We calculate the fluence of gamma rays produced in this way and simulate the resulting changes to terrestrial ozone levels using the Goddard Space Flight Center 2D Atmospheric Model. We also calculate the rate at which such events would occur, using estimates for the mass distribution of these halos within the Milky Way. We find that the ozone depletion from UCMHs can be significant, and even of similar magnitude to the levels which have been linked to the cause of the Late-Ordovician mass extinction event. However, the probability of such encounters over the Earth's entire history is relatively low. This suggests that, while dark compact objects like UCMHs could have had an impact on the Earth's biosphere, other astrophysical phenomena like gamma-ray bursts or supernovae seem a more likely source of these effects.

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