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All the light we cannot see: studying Dark Photon-Photon oscillations in astrophysical environments

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Dark matter (DM) comprises of nearly 80% of the mass of the universe, yet its exact nature eludes us. Specifically, the Dark Photon (DP) is a well-motivated candidate for DM, and offers a relatively simple extension to Standard Model (SM) physics. Dark photons act as a portal between SM and DM particles via kinetic mixing, thus oscillating into photons (and vice-versa) while propagating. For our consideration, DP form a part of the dark sector. These DP may be produced in the Sun, and due to the existence of a non-monotonic plasma potential in the Solar chromosphere, can oscillate back resonantly into photons. We study this oscillation phenomenon to calculate how many of such photons we can detect at Earth. Since the energies of these photons (produced via dark sector interactions) may be higher than that of photons produced via SM processes in the chromosphere, a comparison of the fluxes of these two types of photons can also lead to bounds on the dark photon-photon mixing parameter.

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