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Propagation of converted solar axions inside the surface cool plasma

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Under certain conditions of solar plasma density, magnetic field and eventually field gradient, axions or other exotica with similar properties can be converted back to hard X-rays as they stream out of the hot solar core. A GEANT4 simulation was performed for the propagation of ∼1-10 keV photons in a relatively cool plasma, some 100 km below the solar surface. Due to multiple Compton scattering, the photon's random path depends sensitively on the actual depth of the axion-to-photon conversion place, where the otherwise unexpected X-rays are assumed to be emitted radially outwards. This results to a continuous non-linear energy degradation of the converted solar axion energy spectrum: an initially wide and hard X-ray spectrum is being continuously redshifted into an exponential form, whose steepness (i.e., the power law index) critically depends on the plasma column density above the place of conversion. In addition, an initial pencil-like beam of hard X-rays, when escaping from the solar surface gives rise to a characteristic wide spot (e.g., some Mm). Thus, the measured shape of the energy spectrum, the spatial extension of the outstreaming X-rays, etc., can be regarded (individually or combined) as novel signatures of the solar axion particle ID. If plasma resonance effects are at work for the enhanced conversion to occur, a comparison with X-ray observations from the flaring Sun results, within the axion(-like) scenario, to a rest mass of m_axion ∼10 [meV]. We note that the Monte Carlo results of this work are conventional in nature. Only the origin of the suddenly appearance of X-rays has been motivated by axions or the like.
Further reading:
http://xxx.lanl.gov/ftp/arxiv/papers/0808/0808.1545.pdf