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Two-Photon Absorption by H2 Molecules: Origin of the 2175A Astronomical Band? PETER P. SOROKIN, IBM Research Division (IBM Fellow Emeritus), JAMES H. GLOWNIA, Los Alamos National Laboratory — The near UV spectra of OB stars are often dominated by a broad extinction band peaking at 2175A. Forty years after its discovery, the origin of this band remains unknown, although it is usually attributed to linear scattering or linear absorption by interstellar dust particles. Here we report that two-photon absorption by H2 molecules in gaseous clouds enveloping OB stars should lead to a strong band peaking near 2175A. We first show that if the product of the H2 density in the gaseous cloud times the emitted stellar VUV flux is sufficiently great, the threshold for stimulated Rayleigh scattering will be exceeded, resulting in the generation of intense, monochromatic VUV light at the rest frame frequencies of H2 B- and C-state resonance lines originating from levels J″=0 and J″=1 of X0. This coherently generated light must necessarily propagate radially inwards towards the photosphere of the illuminating OB star, and therefore cannot be detected externally. However, this same light effectively constitutes intense "first step" monochromatic radiation that should induce continuum photons emitted by the OB star near 2175A to be strongly absorbed as "second steps" in resonantly-enhanced H2 two-photon transitions to two well known doubly-excited dissociative states of H2. Archival UV and VUV spectra of 185 OB stars strongly support our nonlinear model for the 2175A band.

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