Supervisor: Professor Matthew Adams

Project Title: Illuminating the Role of Sunlight as a Prospective Driver of Indoor Photochemistry

Project description: Despite traditional beliefs that indoor systems are mostly devoid of high energy ultraviolet (UV) photons, recent works show that indoor irradiance of UV light (340-400nm) can reach one-third of outdoor levels in direct sunlight (Alvarez et al., 2014; Bartolomei et al., 2014). This threshold of UV light (340-400nm) operates within the photolysis threshold (≤ 398nm) for nitrogen dioxide (NO_2), where the formation of ozone (O_3) occurs within our troposphere (Jones & Bayes, 1973). Recent studies theorize that NO_2 photolysis may be an important source of O_3 to the indoor environment, nonetheless, indoor oxidation processes and their estimated reaction products remain poorly characterized (Gandolfo et al., 2016; Kowal, Allen and Kahan, 2017). The potential for sunlight to elevate O_3 levels within the indoor atmosphere is of great concern amid the ongoing Coronavirus-2019 pandemic, as short-term elevated exposure to O_3 can impair immune resistance to viral respiratory infections, including past human coronaviruses (Cui et al., 2003; Chauhan & Johnston, 2003; Ciencewicki & Jaspers, 2007). The objective of my research is to assess the impact of sunlight on the photochemical formation of O_3 indoors and how this varies over space and time. To evaluate this, I will characterize the wavelength of incoming solar light over different timescales using a spectral irradiance meter while simultaneously assessing changes to indoor O_3 and NO_2 levels using passive air samplers. These measurements will be paired with continuous monitoring of indoor and outdoor gas-phase chemicals that influence the formation and elimination of O_3.

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