☐ **Talk** ☐ **Poster**

Decoding the Drivers of DOC: Coupled Solar–Microbial Exposure System For Optical and Chemical Analysis of Dissolved Organic Carbon Concentration and Composition

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Aquatic systems are increasingly recognized as critical carbon regulators in recent times, especially in the context of anthropogenic emissions. Dissolved organic carbon (DOC), a major reservoir in the carbon cycle, serves as a proxy for biogeochemical shifts and stressor-induced ecosystem responses. However, drivers of DOC concentration and composition remain poorly understood. Here, we analyzed the combined effects of sunlight and microbial activity on the concentration and aromaticity of DOC in a headwater stream of Harvard Forest (HF). We prepared four treatments of a sample collected in July 2025 from the Arthur Lower brook: two filtered with 1.5-µm glass fiber filters (GFC) and two filtered with 0.7-µm glass fiber filters (GFF). The GFC treatments had a more complete microbial community than the GFF samples. Using a custom-made irradiation system, we exposed two treatments (one GFC and one GFF) to solar simulator radiation. The remaining two treatments were used as dark controls. For ten days, we sub-sampled the four treatments to measure UV-visible absorbance and DOC concentration using a spectrophotometer and a TOC analyzer, respectively. We processed spectral data for a_{g250}, the absorption coefficient at λ=250 nm. Our results for the light-exposed samples show linear decreases in both a_{g250} and DOC concentration. Calculating specific ultraviolet absorbance (SUVA) as a proxy for DOC aromaticity, we found a linear increase in light-exposed samples. The dark control samples exhibited similar trends in all metrics, but to a lesser extent. From these results, we conclude that the coupled effect of radiation exposure and microbial activity accelerates the degradation of DOC via photochemical reactions and microbial mineralization. Additionally, microbes were able to mineralize labile forms of DOC at a rate faster than radiation breaks down aromatic (non-labile) compounds. Our results enhance understanding of how forested aquatic systems regulate carbon under ongoing environmental change.