



## Department of Chemistry Seminar Series Spring 2023

Monday, March 20, 2023, 3:30 PM – HPA1-O119 (Health Sciences)

### Chemical approach to tire mark analysis



**John Lucchi**

Department of Chemistry and National Center for Forensic Sciences  
University of Central Florida  
Advisor: Matthieu Baudelet

Fatal accidents on the road are an unfortunate daily occurrence, with almost 27,000 fatalities resulted from hit and runs in the USA between 2006 and 2020. The identification of the driver responsible for this road crime can become a challenge. Nonetheless, the accident scene provides a large amount of trace evidence that can prove critical to this matter, one of them being the tire marks. While traditional tire mark analysis is full of physical information helping the reconstruction of the event, additional information can be extracted from the rubber left during the braking event. Each tire model is manufactured with a specific design, obtained by a chemical formulation that can become its signature. Supplemental to the molecular profile of the rubber itself, analysis of the trace and contaminant elements can help build the chemical signature for the tire rubber. My PhD work consists of establishing the link between the tire and the mark it made during a braking event.

The difference between tire models was proved using Laser-Induced Breakdown Spectroscopy (LIBS) from the tire rubber itself, showing that while most tires are manufactured with a similar polymer matrix, the specific content of minor and trace elements is specific to the model. Expanding to the problem of tire marks, the first challenge consists in efficiently sample the rubber from the road and the development. The development of an efficient procedure to lift the tire particles from the mark is demonstrated in this work. This does present some challenges, including removal of other particles present within the lift and extraction of the tire rubber for further analysis by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). Finally, with the skid mark rubber analyzed, it is compared with the elemental profile of the rubber from the source tire. The results of this comparison will be discussed in both simulated (with a lab-made tire mark maker) and field cases (from braking tests performed by the Florida Highway Patrol).

The results of my research provide the forensic community with the first evaluation of elemental analysis of tire rubber as a mean to use this seldom used trace evidence, all along the analytical process, from sampling to analysis to attribution.