Bio: Alexander Crain is a PhD candidate in the department of Mechanical & Aerospace Engineering at Carleton University, where he is working under the supervision of Professor Steve Ulrich in the Spacecraft Robotics Laboratory. His research focus is on using neuromorphic vision for spacecraft proximity operations, specifically for spacecraft point cloud reconstruction and pose estimation of uncooperative resident space objects.

Abstract: Event cameras are of particular interest for spacecraft proximity operations due to their microsecond latency, 120~dB of dynamic range, sparse data output, and low power. This presentation introduces a combined filtering and accumulation pipeline for processing event camera data under highly dynamic scenes with challenging lighting. This pipeline includes: (1) a filtering stage which leverages per-pixel inter-event interval regularity, spatial density, and temporal persistence; and (2) a per-pixel adaptive accumulator in which the decay time constant of each pixel is derived directly from its own inter-event interval statistics. In contrast to current approaches, the filtering and accumulation stages are not treated as separate processes, with outputs from the filtering stage feeding directly into the accumulator. This research also introduces a comprehensive public dataset (EVOS: EVent-based Observation of Spacecraft), which was collected using Carleton University's Spacecraft Proximity Operations Testbed. Experimental validation demonstrates that output frames are effectively denoised, while still retaining detail in low-activity regions and suppressing motion blur in high-activity regions. Of particular note, results demonstrate that the proposed pipeline reconstructs frames better in low-light and harsh lighting scenes with high glare when compared to the current state-of-the-art methods.