Polarized Vehicle Headlights: A Novel Solution to Nighttime Snowblindness Affecting Human Drivers & Autonomous Vehicles

Primanis-Erickson, Nicholas (School: Pinedale High School)

“Nighttime snowblindness” results from brightly lit snowflakes moving toward the driver/pilot/operator of cars, trucks or other equipment moving over ~20mph. Humans instinctively focus on bright objects moving rapidly toward them therefore making it difficult to focus on road signs and hazards when driving. In snowy climates drivers especially have trouble pushing their focus past the brightly-lit oncoming snow. This particular problem occurs in other environments where glare is reflected from particulates or microdroplets: rain, dust storms, fog, smoke or cloudy water. In each case, reflected glare dilutes light arriving from objects in the environment, making visual processing difficult. The new technique developed in this project uses perpendicularly oriented cross polarization filters to selectively remove unwanted glare from airborne particulates. It was inspired by an old photographic method to remove glare in pictures. The old photographic method was also adapted to solve the related problem of reducing oncoming glare from headlights decades ago, however was ineffective due to thermal damage. That problem can now be inexpensively overcome with certain newly-developed LEDs, and a simple device adapted from the field of high-energy lasers: a Pockels cell using lithium niobate. Sample applications include autonomous vehicles, aviation, submersibles, military battlespaces, and search-&-rescue. Since the technique is not limited to visible light, it has applications in infrared-aided driverless vehicles and other non-civilian imaging problems. This project developed a lab-scale model of the proposed technology, applied to the “snowblindness” test problem. Visual quality was substantially improved by the technology, and further development seems warranted.

Awards Won: